THE DENTAL PRACTITIONER

AND DENTAL RECORD

Including the Transactions of the British Society for the Study of Orthodontics, and the official reports of the British Society of Periodontology, the Glasgow Odontological Society, the Liverpool and District Odontological Society, the North Staffordshire Society of Dental Surgeons, the Odonto-chirurgical Society of Scotland, and the Dental and Medical Society for the Study of Hypnosis

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THE DENTAL PRACTITIONER
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Vol. IX, No. 9 May, 1959

EDITORIAL

WHAT SHAPE AND SIZE THE TOOTHBRUSH?

WHAT kind of toothbrush do you advise for a patient?

Which type of brush keeps the teeth most free of debris, stimulates the periodontal tissues without injuring them?

How often a dentist gets asked these questions. How rarely can he give a satisfactory answer. For the truth is that very little laboratory research has apparently been done on the ideal shape and size of the common toothbrush, and none resulting in a standardized report being issued by a recognized organization.

Certain individual firms—and individual practitioners—have seriously examined the problem, but the still-existing wide diversity of opinion indicates that this has not had far-reaching results.

Toothpastes—whether considered of great value or not—have all developed on a certain basic formula, but brushes continue to appear on the market of every size, shape, and quality.

When one manufacturer approached dental experts for guidance, he was given so many varying opinions that he told THE DENTAL PRACTITIONER, "I decided to devise a brush incorporating what seemed to be the most important points".

Again, a journal devoted to market research on behalf of the consumer recently reported on the relative merits of certain branded toothbrushes. Their yardstick: how long would each brush stand up to use? Their recommendation: the one which retained its bristles the longest.

Value for money, yes, but is this good for oral hygiene?

Another market research inquiry came up with the comment that most people kept any one toothbrush for twenty-one months. No comment was added on the state of the bristles or on their cleanliness!

But, even disregarding length of life and details of design, further controversy still rages from time to time on the opposing merits of nylon and bristle. Which is the least harmful to the soft tissues of the mouth? Without consistent dental opinion can any manufacturer provide a completely impartial view when bristles of the best quality cost around ninety shillings a pound and nylon about fourteen shillings a pound?

Yet an impartial view is badly needed: a memorandum of guidance for the manufacturer devised by a responsible authority.

Is this not a job for the British Standards Institution? For the periodontal departments of our schools, or even the periodontal societies themselves?

The toothbrush is a fundamental aid in the battle against dental disease; surely, then, it is worthy of extensive and productive research?

BETTER AMALGAM FILLINGS

By S. L. **PEARSON**, B.D.S., F.D.S. R.C.S.
The University of Liverpool

OBSERVATIONS during the supervision of students' clinical work, and inspection of many mouths both before and during the course of treatment, indicate that there are a number of common errors made in the preparation of teeth for amalgam fillings and in the actual insertion of the filling material. Furthermore, personal clinical practice has convinced me that attention to these details results in a finer filling, which not only looks superior at the time of completion, but remains a credit to one's efforts several years later; for it can be a disturbing revelation to examine fillings inserted some years previously.

Therefore, it is proposed to stress some of the points to which sufficient attention is not routinely paid.

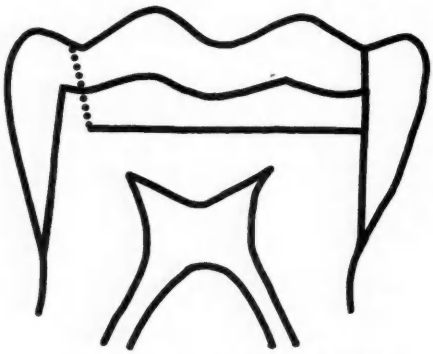

Fig. 1.—Cavity wall inclined towards the marginal ridge (broken line) to avoid unsupported enamel (heavy line).

CAVITY PREPARATION

1. Adequate Extension.—It is impossible to finish the margins of a filling flush with the surface of the tooth where fissures or deep grooves radiate from the periphery. The result is ledges where debris collects and brings about a recurrence of caries. Caries is also liable to commence in some other part of the tooth not included in the original cavity. Except in occasional situations, such as a middle-aged patient with low caries susceptibility, it is wise to include all surface defects in the cavity.

Where fissures approach the buccal and lingual surfaces of the tooth, or extend well on to the marginal ridges, the bur should be inclined so as to cut out the defect in enamel without removing the underlying dentine. In this way the enamel walls are not weakened. There is a definite tendency to incline the bur in the wrong direction and leave the enamel unsupported (*Fig.* 1).

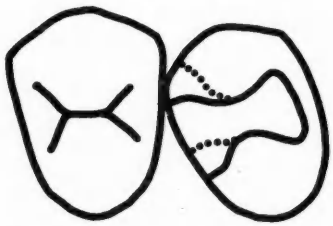

Fig. 2.—Correct Class II cavity outline in a rotated premolar to give proper extension for prevention (broken line). Incorrect outline with over-extension on the palatal side and under-extension on the buccal side (heavy line).

The buccal and lingual margins of proximal cavities should be extended into the embrasures in order that they will be subject to the scouring action of the food passing on either side of the contact and readily accessible to the toothbrush.

It is frequently observed that where a premolar is rotated a cavity is cut to conform to a so-called "classical" outline rather than to satisfy the principles of cavity preparation, so that one margin remains in a stagnation area (*Fig.* 2).

Extending these margins so that the cavity is slightly wider at the gingival than at the occlusal not only provides for greater retention but also extends the cavity past the undercut stagnation areas.

The gingival margins of proximal cavities should be placed under cover of the interdental papilla, so that plaque formation will not initiate caries beneath the margin of the filling. The enamel should be finished in the direction of the prisms with a sharp margin trimmer. So often the margin is left above the level of the papilla with a ridge of already decalcified

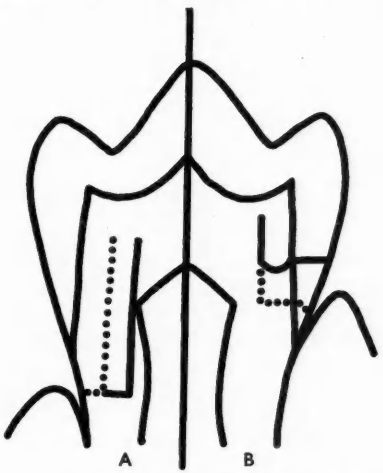

Fig. 3.—A, Where it becomes necessary to extend a Class II cavity on to the root the gingival wall must be kept narrow (broken line) to avoid risk of exposure (heavy line). B, Correct extension of the gingival wall below the interdental papilla and the margin finished in the direction of the enamel prisms (broken line). Gingival wall left above the interdental papilla with a ridge of unsupported enamel (heavy line).

and unsupported enamel standing above the dentine of the gingival wall (*Fig.* 3 B).

This extension of the gingival margin under cover of the interdental papilla is contra-indicated in cases of gingival recession; here the wide gingival embrasure permits cleansing of the gingival margin. It is only necessary to extend sufficiently far to break contact with the approximating tooth and remove all unsound tissue. Where caries necessitates extension on to the root, it must be remembered that the gingival wall should be kept narrow to avoid exposing the pulp (*Fig.* 3 A).

There is also a general reluctance to extend gingival cavities correctly, although there is probably no other situation where caries recurs so quickly at the margins of an under-extended filling. The mesial and distal margins should extend to the line angles of the tooth, the gingival margin under cover of the free gingiva, and the occlusal margin sufficiently far occlusally to bring it out of the stagnation area (*Fig.* 4). Even then, decalcification at the cervix will often necessitate extension of the cavity right round on to the proximal surface.

Whilst controversy reigns with regard to the advisability or otherwise of leaving caries on

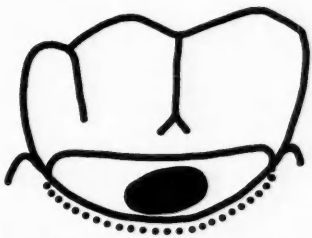

Fig. 4.—Underextended Class V amalgam filling. Correct extension of a Class V cavity—broken line indicates extension below gingival level.

the pulpal or axial walls of cavities, there can be no argument against the rule that it should be completely removed from the lateral walls. It is very easy to overlook caries beneath the cusps unless the cavity is dried completely and each wall carefully inspected with mirror and probe. In this connexion the practice of clearing cavities during the course of preparation by means of subjecting the tooth to a blast of cold compressed air is to be deplored, for not only does the pulp receive a series of thermal shocks, which are not registered following the use of local anæsthesia, but usually a considerable amount of debris remains to obscure the vision. It is far preferable to wash the cavity with a gentle stream of warm antiseptic solution and mop out with cotton-wool pledgets, and then, if necessary, apply a *gentle* puff of warm air.

One of the commonest mistakes in cavity preparation is to excavate caries from beneath a cusp and then fail to cut back the unsupported enamel. Removal of this enamel will usually

reveal caries extending along the amelodentinal junction well under the cusps, which would continue to spread after the filling was inserted. Moreover, the unsupported enamel is liable to fracture later (*Fig.* 5).

When preparing a cavity in a grossly carious tooth there is a disinclination to remove cusps

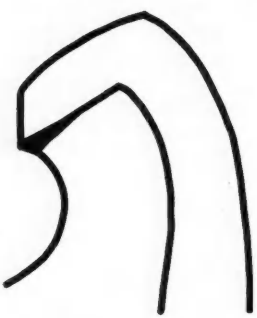

Fig. 5.—Caries extending along the amelodentinal junction beneath a cusp not visible until the overhanging enamel is removed.

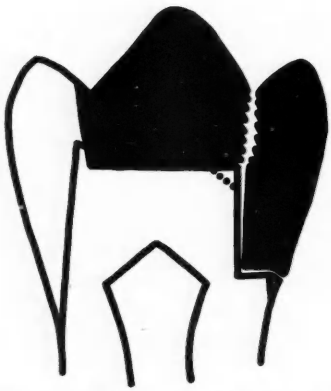

Fig. 7.—Rounding of axiopulpal line angle to reduce danger of fractured filling.

completely denuded of dentine, and where the tooth is tilted, taking the cusp out of occlusion, such action is often permissible. However, where the cusp is in normal occlusion it is advisable to remove the enamel rather than leave it to break away later.

2. Retention and Resistance Form.—Class II amalgam fillings often fracture across the junction of the occlusal key and the greater proximal portion. This can be prevented by making the key the correct depth, and by providing for adequate width in this vital area (*Fig.* 6). The restoration is also made stronger by rounding the axiopulpal line angle, which apart from removing the mechanically weak angle in the amalgam allows for greater bulk at this point (*Fig.* 7). Also, it is frequently found that there is insufficient access for even the smallest condensing instrument when the isthmus is narrow, resulting in inadequate

Fig. 6.—Fracture of a Class II amalgam filling and thin, weak edges due to flaring of enamel walls. Correct outline of Class II cavity with adequate width across the keyway and walls at right angles to the tooth surface (broken line).

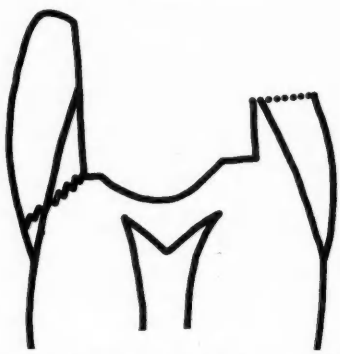

Fig. 8.—Reduction of weak cusp to prevent fracture.

condensation of the amalgam and reduction in strength.

Extensive caries necessitating wide extension of the occlusal part of a cavity leaves the cusps very weak and liable to fracture. Such thin cusps should be reduced by at least 3 mm. and restored with amalgam (*Fig.* 8). Reduction of the cusps by less than this amount will provide for but a thin veneer of amalgam that

fails to withstand the occlusal stress and breaks away.

3. Finish of Enamel Walls.—One might expect that after a cavity has been cut with a fissure bur there will be no weak or unsupported enamel prisms. Careful planing of the cavity walls with sharp enamel chisels demonstrates that the enamel is not always as strong as it might appear, and this stage of cavity preparation should never be omitted.

A particularly common failing is to leave sharp spurs of enamel that will break away after the amalgam is placed, producing voids at the margins in which debris will accumulate to start further caries (*Fig.* 9).

The buccal and lingual walls of a Class II cavity should be finished at right angles to the surface of the tooth, thus giving a filling with strong margins. Flaring of the walls produces a filling with thin, weak edges; moreover it is difficult to condense amalgam satisfactorily into the narrow angles formed by such walls and the matrix band (*Fig.* 6).

Whilst it is desirable to finish the walls of an inlay cavity with stones and sandpaper disks, such procedures must be avoided in the preparation of amalgam cavities as there is a tendency to round off the cavosurface angle, which again results in a filling with weak edges that later break away to leave a ledge for the accumulation of debris. Correct planing of the enamel with sharp chisels produces a sharp cavosurface angle and a strong margin to the amalgam.

FILLING THE CAVITY

1. Fitting a Matrix.—One of the aims of any restoration is to restore the tooth to normal function, not only as an efficient unit of mastication, but also as a protector of the supporting tissues: a function which is often overlooked. A correctly contoured filling deflects the food over the surfaces of the tooth and through the buccal and lingual embrasures in such a way that the marginal gingivæ are subject to frictional stimulation. Therefore, it is necessary to adapt a matrix band for Class II cavities that will shape the filling as well as retain it during condensation.

The first common error is to use a matrix band that is too wide and extends well beyond the occlusal surface of the tooth, obscuring vision and access and making it difficult to carve the marginal ridge to the correct height. A suitable band should be selected and, if necessary, trimmed with scissors to extend just

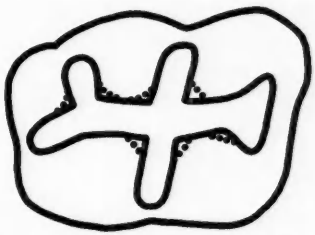

Fig. 9.—Rounding of sharp spurs of enamel.

beyond the cavosurface angle of the cavity and the future level of the marginal ridge. It is then essential to ensure that the band is firmly adapted to the tooth at the gingival margin of the cavity, otherwise amalgam is forced between the tooth and the band, forming a ledge which irritates the interdental papilla and eventually leads to pocket formation. In practically every case this can only be achieved by means of a wedge passed through the gingival embrasure from the lingual side. Such a wedge can be most conveniently cut with a sharp scalpel from a wood point used for gingival massage, and should be quite finely tapered and triangular in cross-section to fit the small triangular space of the gingival embrasure.

The tendency is to fashion a sliver of wood that bulges the matrix into the cavity, resulting in a large space between the filling and the approximating tooth in which debris accumulates.

Having wedged the matrix, it should be ascertained that it is in fact tightly applied to the tooth by testing with a sharp probe, for occasionally a further wedge is found to be necessary on the buccal side. A specific occasion is a mesial cavity in a maxillary first premolar where the gingival margin is concave due to the presence of the canine fossa.

Whereas the normal anatomy of the proximal surface of a tooth is convex, the matrix band is quite flat, and unless steps are taken to contour the band the restored tooth will also have a flat surface, resulting in over-wide embrasure form which permits the food to impinge upon the marginal gingivæ. Furthermore, unless the

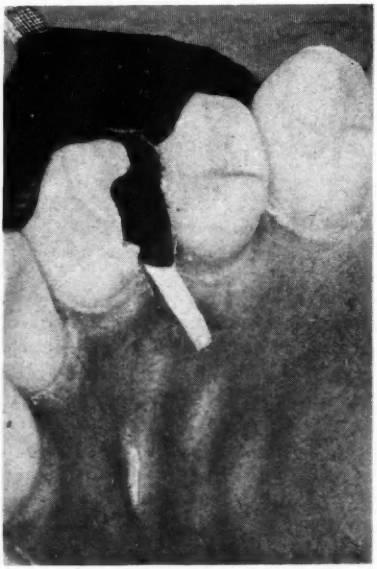

Fig. 10.—A suitable matrix for a Class III amalgam is a piece of soft metal strip, wedged at the gingival margin, supported with composition on the labial side, and contoured with a warm burnisher.

matrix band makes tight contact with the approximating tooth, a space will exist between the filling and the approximating tooth into which food will pack down on to the interdental papilla and ultimately give rise to a parodontal pocket.

The two last-mentioned errors can be overcome by burnishing the matrix band against the approximating tooth with a ball-ended instrument from inside the cavity.

There is no doubt that despite every effort at contouring, stock bands and retainers, no matter what the design, leave a lot to be desired, and the individual matrix fashioned from soft metal reinforced with composition is far superior. This type of matrix is the only one applicable when faced with the task of condensing amalgam into a Class III cavity (*Fig.* 10).

The production of a well-condensed and contoured Class V amalgam filling is not at all easy. Once the cavity has been filled to the cavosurface angle, Didner's design condensing instruments have been found very useful for condensing and contouring excess over the margins of the cavity. The excess can then be trimmed away most readily with a trimming probe.

Extensive Class V cavities are most conveniently filled in sections. Half the cavity is filled with cement, then the other half with amalgam. Subsequently the cement is removed and the amalgam filling completed.

2. Triturating the Amalgam.—It is firstly necessary to proportion the alloy and mercury in the correct ratio (Phillips, 1957), and there is no doubt that weighing out in a small balance is the most accurate method. It would seem, however, that the newer dispensers delivering alloy and mercury together are reasonably reliable.

The next step is to mix the two together until trituration is complete. This is achieved using a hand mortar and pestle, when the mass becomes silvery in appearance and clings to the walls of the mortar. Often the amalgam is removed before this stage is reached, and such an undertriturated mass results in a filling with low crushing strength (Phillips, 1957).

When the amalgam mass has been completely triturated, it should be scraped together with a suitable spatula and transferred to a clean folded gauze napkin. The four corners of the napkin are then brought together and the mass squeezed to express the excess mercury. Using the new fine grain alloys it is advisable not to squeeze out the mass completely or it will be found to be insufficiently plastic. This technique ensures that the amalgam is not contaminated with moisture from the skin, for it is now well known that such contamination is one of the causes of porosity, excessive expansion, and decreased strength (Phillips, 1957).

The new fine grain, quick setting alloys commence to crystallize only 5 minutes after trituration, which means that where a very large filling is being condensed the last portions of amalgam are becoming dry and crumbly and the act of condensation is breaking up the forming crystals. It is advisable when placing such a large filling to triturate the amalgam in several small amounts, and a mechanical amalgamator is useful for this purpose, for if

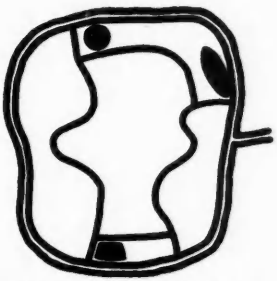

Fig. 11.—Oval or trapezoid section instruments are used to condense amalgam into the angle formed by the matrix band and the walls of the cavity where a round section instrument fails.

the alloy and mercury have been previously weighed out into a series of capsules, the chair-side assistant can set the machine in motion to triturate a fresh portion while she is handing a previous mix to the dentist. The use of a mechanical amalgamator also removes the human factor, ensuring a uniform standard mass of greater crushing strength, with no possibility of contamination.

3. Condensing the Amalgam.—As mentioned earlier, moisture contamination of amalgam is to be avoided, making it imperative to keep the tooth absolutely dry during the filling of the cavity. Just to provide the patient with a saliva ejector and place a cotton-wool roll in each side of the tooth is not always enough, for so often the rolls become saturated before the completion of the operation, allowing saliva to percolate into the cavity. Careful watch must be kept on the rolls so that they can be rapidly replaced as soon as they show signs of becoming saturated.

The most fool-proof method of tooth isolation is, of course, the rubber dam, and it is felt that in those patients with a copious flow of saliva it saves time to apply one.

Great care is necessary in filling the cavity to produce a well-condensed restoration without voids or porosity and with strong margins. Here again there are several points of technique that are constantly overlooked.

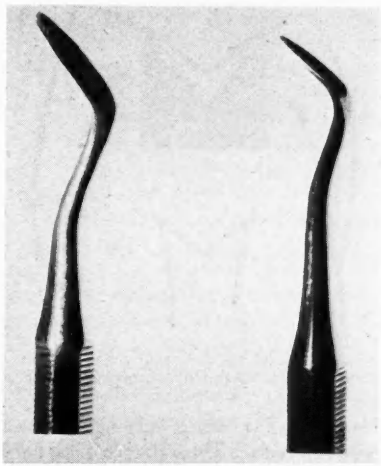

Fig. 12.—An amalgam carver fashioned by grinding a No. 6 plastic instrument.

The amalgam should be packed into the cavity in small portions at a time with as large a flat-ended condensing instrument as can reach all points of the cavity, using the *maximum force it is possible to exert* with a well-supported hand. A round-section condensing instrument will not reach into the angles formed by the matrix band and the buccal and lingual margins of the proximal box of a Class II cavity. Consequently mercury is squeezed out of the mass into these angles giving the finished filling weak edges. Oval or trapezoid section instruments are required to condense these areas thoroughly (*Fig.* 11).

As condensation progresses, mercury is brought to the surface and flicked away before adding the next portion of amalgam.

Once the cavity has been filled, it is a common practice to mould the mercury-rich top layer with a round-ended instrument to the

desired contour. This malpractice results in a filling with a porous surface and weak edges. The correct procedure is to condense excess amalgam over the margins of the cavity with a very large flat-ended instrument to absorb the last of the excess mercury from the bulk of the filling. This excess amalgam is then

Fig. 13.—Excessively deep contouring reduces the bulk of amalgam and produces thin, weak margins.

cut away with a sharp carving instrument, the correct anatomy of the occlusal surface being established at the same time. A No. 6 plastic instrument, ground as shown in *Fig.* 12, has been found most convenient for this purpose.

4. Contouring the Filling.—Using the new fine grain alloys, carving can commence immediately condensation has been completed, the blade of the instrument being rested on the enamel and carried round the margins to cut away the excess and follow down the cuspal inclines. In this way there is no danger of leaving the margins of the cavity exposed. There is a tendency to leave excess in the supplemental grooves that will break away to form a ledge for the accumulation of debris, and it is a help to visualize the outline of the cavity. Another failing is to produce a bulky, rounded marginal ridge which favours food packing, as compared with the correct marginal ridge form which helps to deflect food away from the contact.

Excessively deep contouring should be avoided in the interests of preserving a strong bulk of amalgam (*Fig.* 13).

By the time the occlusal trimming is completed, the wedge and matrix can be removed. So often when this is attempted in an occlusal direction, the whole filling or at least the marginal ridge is disturbed. The wisest procedure is to remove the retainer and pull the band through from the lingual side. If using a type of retainer that is not readily freed from the band, the best solution is to slacken off the retainer and slit the band with a pair of sharp scissors so that it can be pulled through the embrasures.

Invariably excess amalgam is found at the buccal and lingual margins; this is most easily removed with a square-section sickle-shaped trimming probe.

The final act before dismissing the patient is to check that there is no interference with occlusion. Patients have a nasty habit of clamping the jaws tightly together unless previously cautioned to close very gently, and as a high spot will not show as a shiny area unless fair pressure is applied, thin articulating paper is helpful in disclosing such areas.

Time spent in contouring a filling and removing all excess is amply repaid at the finishing stage, when very little should be required other than smoothing and polishing.

SUMMARY

The following points have been stressed in the restoration of teeth with amalgam:—

1. Correct cavity extension and outline form.
2. Correct retention and resistance form.
3. Careful finishing of enamel walls.
4. The importance of a correctly adapted and contoured matrix.
5. Correct manipulation and condensation of the amalgam.
6. Withdrawal of the matrix and final trimming.

Acknowledgements.—I wish to thank Professor F. E. Lawton for his advice, and Mr. and Mrs. J. S. Baillie for assistance with the illustrations.

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A CENTURY OF PROGRESS

By C. BOWDLER HENRY, L.R.C.P., M.R.C.S., F.D.S., R.C.S. (Eng.)
Royal Dental Hospital of London, School of Dental Surgery

THE Royal Dental Hospital of London and School of Dental Surgery are now celebrating their Centenary. Last year, Her Majesty the Queen graciously accepted an invitation to visit the Hospital and to open the new extension to the School. And so on June 4, as Patron, the Queen toured the Hospital and saw the students at work. It was a most memorable and impressive occasion, and no less so was Her Majesty's friendly interest in all she saw.

This month, on May 8, Her Majesty Queen Elizabeth the Queen Mother (as Chancellor of the University of London) attended the centennial celebration dinner given by the Governing Body of the School. For the School, in its own right, is a school of the University, in the Faculty of Medicine.

It seems appropriate now to tell of the more outstanding features in the hundred years of these twin institutions.

The London School of Dental Surgery and the Dental Hospital were the children of the Odontological Society of London. Not only did the Odontological Society originate this dental teaching hospital, but immediately it was open the Society held its meetings there, and continued to do so for another forty years. Here it developed its remarkable and extensive library and museum. No wonder the odontologists spoke of "our hospital". No wonder the Students' Society (1862) declared as one of its objects that members, on qualifying, would be better able to take their places in the Odontological Society.

It would take too long to tell the complicated history leading to the founding of the Odontological Society; but suffice it to say the Council of the Society persuaded Parliament and the Royal College of Surgeons to recognize dental surgery and to grant the diploma of L.D.S. R.C.S. The Odontological Council also drew up a curriculum which has been the basis for all subsequent teaching in England.

A Committee was appointed to set up a school in May, 1858. Within a month, this Committee reported that a necessity before opening a school would be a voluntary hospital. This would enable students to gain clinical experience from the start. Accordingly, a Dental Hospital of London Organizing Committee was appointed, consisting of the President of the Odontological Society and twelve other members. It lost no time in obtaining the money (mostly from the dental profession) and procured an influential patronage.

The hospital was handed over to a Committee of Management on October 6, 1858. The hospital actually opened its doors to patients on December 1 of that year. By April, 1859, the following report was received:—

"The Medical Officers of the Dental Hospital of London beg to report to the Committee of Management that the number of patients has continued to increase. The cases which come under treatment of the Dental Surgeons, are now sufficiently numerous and varied in character to afford ample means for the instruction of pupils in dental surgery."

The London School of Dental Surgery was opened to students on November 1, 1859. Then, in 1874, the institution moved from its first home in Soho Square to larger premises in Leicester Square. At the end of the century it was already cramped for room and a new hospital was built (the existing one) on an adjacent site, to which it moved in 1901.

In the same year, His Majesty King Edward VII, the Patron, gave his consent to the prefix "Royal" in the title.

In 1911 the London School of Dental Surgery became a School of the University in the Faculty of Medicine. In 1946, under the National Health Scheme, the School was constituted a "Body Corporate with a Perpetual Succession and a Common Seal", with the title of "The Royal Dental Hospital School of Dental Surgery".

In other words, the School then became a separate entity, having all the rights of legal status, the government of the School being vested in the Governing Body. Also, under the National Health Scheme, the Hospital passed into the St. George's Hospital Teaching Group. The administration of the latter is now managed by the Board of Governors of St. George's Hospital

As to the "Royal's" achievements, it must be remembered that its life covers almost the whole of the period of scientific dentistry as we know it. At its birth, vulcanite was just coming in; the adjustable dental chair had barely made its appearance, likewise the dental "burring" engine.

In 1868 Thomas Evans, the famous American dentist of Paris—and benefactor of an equally illustrious school in the United States—demonstrated nitrous oxide anæsthesia at the Hospital. He also gave a donation of one hundred pounds for further experiments with the gas there.

The two chloroformists to the Hospital, Clover and Potter, with four members of the honorary dental staff, Coleman, Hepburn, Tomes, and Underwood, were members of the Nitrous Oxide Committee. Coleman experimented, even in those days, with nasal administration. His "economizing apparatus" for absorbing carbon dioxide, thus enabling the exhaled nitrous oxide to be used again, is the basis of the modern closed-circuit technique.

For the training of its students the School demanded the meticulous discipline of the cohesive gold filling. In the early days of this form of filling, a special demonstrator was appointed. (In 1889 Sir J. F. Colyer was made "Demonstrator of Contour and Cohesive Fillings".)

The School was always ready to welcome a practitioner and show him the latest improvements in techniques and treatment. Whenever there was a conversazione, a large display of exhibits was arranged. By 1905 the clinical "At Home" became a regular annual feature, sometimes as many as seventy patients were demonstrated, with an attendance of over three hundred visitors.

Inevitably, these occasions become whole-day affairs, with operation sessions added. The variety of clinical demonstrations was especially interesting since, by tradition, members of the senior staff were not only medically qualified, but were also consultants on the staffs of one of the big teaching hospitals. Not only did this add prestige to the Dental Hospital in fact, it could be truly said that in matters of diagnosis of oral conditions and their treatment there were at Leicester Square the best brains in the country. A vast number of difficult diagnoses have been made—of incalculable value to the private practitioner.

The eminence of a hospital and its power for good depend, not only upon the wisdom of the controlling committees, but also upon the attainments of the members of the staff. Besides the scores of "communications" to scientific meetings made by successive generations of the Hospital's staff, we have the great text-books of the past as evidence of both the tradition and wisdom of our teachers.

Many outstanding works come to mind, such as John Tomes's *System of Dental Surgery*, elaborated from his early lectures at the Middlesex Hospital. Smale and Colyer's *Text Book of Dental Surgery and Pathology*, which is to-day's Colyer and Sprawson, C. S. Tomes's *Manual of Dental Anatomy*, now in its eighth edition—and still the authoritative work on this subject. Then there are Hopwell Smith's *Dental and Oral Histology*, and Norman Bennett's *Science and Practice of Dental Surgery*.

There were also the voluntary Postgraduate Lectures, when members of the staff were able to inform the practitioners outside upon the latest researches being carried out. One such lecture was given by Sir Alexander Fleming, then a member of the Hampton Hale Research Advisory Committee. Annual Reports were published for some years, comprising the substance of the Postgraduate Lectures and other original papers.

For several years, too, popular lectures were given at the Hospital, instructing the public in oral hygiene and the causes of oral and dental diseases.

In 1909 the first X-ray department was installed. This had full facilities, not merely for intra-oral work, but for extra-oral stereoscopy as well. This has always been a progressive department, pioneering new developments right up to to-day's achievements in panoramic rotography.

Between the wars there were the remarkable developments in electrotherapy, ionization, ultra violet light, long and short wave diathermy. There are a large number of sufferers in this "No-man's Land" between dentistry and medicine. The Royal Dental Hospital was the first and, for all the writer knows, it is the only dental hospital to provide for these patients. This is a special department under the care of a medical officer-in-charge.

Early attempts were made by the "Royal" to provide for the comfort of in-patients—not only for operations, but also for those very sick dental patients whose home circumstances would preclude their having the necessary attention. An adjacent site was obtained in 1912 for this type of extension, but the 1914–18 War intervened and the plan was abandoned.

However, in 1929 the Royal Dental Wards were acquired in an extension of Charing Cross Hospital. The same facilities have been continued in the Tomes' Ward of St. George's (Tooting) Hospital. These wards started somewhat as a luxury, but quickly became a necessity. The "Royal" could not now visualize fulfilling its obligations to the practitioners and their patients without the wards.

Needless to say, from the point of view of the consultant staff, this facility is invaluable. Treatment which might otherwise have been confined to minor oral surgery has developed into first-class maxillo-facial surgery. There is also the added opportunity for making full-length cine films and photo records, thanks to a progressive photographic department.

In 1931 the late Sir Norman Bennett had the idea of converting the old system of children's regulation into a more academic department. A new orthodontic department was formed, with Sir Norman as director. Outside practitioners were invited to send cases for consultative opinions and guidance during treatment. This department, especially in its consultative and research sides, has grown beyond all expectations and carries a readership in the University.

Lastly, some notes on the Hampton Hale Research Laboratory. This was founded at the Hospital in 1926. Here, under the directorship of J. G. Turner, and supported by an erudite Advisory Committee, Sir E. Wilfred Fish and his enthusiastic disciples carried out some fundamental work, forming the basis of to-day's endodontics. This is just one item of research which has been carried out in this valuable department.

In 1950 the department of pathology obtained a readership at the University. This was elevated to a professorship of oral surgery in 1954, with a large staff of no mean strength both academically and technically.

The most recent professorship in the School is that of dental prosthetics, which was created in 1957. This department started in 1890 as the Appliance Department, under the supervision of the Lecturer on Dental Mechanics, David Hepburn.

Osteogenic Potential of Calcium Hydroxide

An investigation was carried out in which calcium hydroxide and eleven other substances were implanted in the tissues of rats. This was done by placing pellets subcutaneously through incisions on the backs of the experimental animals. The animals were sacrificed at various intervals from 2 to 87 days, and sections made of the implanted areas. Bone-like tissue was observed consistently around the specimens, the earliest being 10 days after implantations. Only 3 of the other 11 substances gave any evidence of calcification—these were barium sulphate, plaster-of-Paris, and magnesium hydroxide. It appears that calcium hydroxide was a unique potential in the formation of heterotropic bone when implanted in the connective tissue of rats.—MITCHELL, D. F., and SHANKWALKER, G. B. (1958), *J. dent. Res.*, **37**, 1157.

A MEANS OF SUPPORTING PARALYSED FACIAL MUSCLES

By **A. J. W. TURRELL**, L.D.S.
The Charles Clifford Dental Hospital, Sheffield

DYSFUNCTION of the seventh or facial nerve results in a facial paralysis which may be temporary or permanent, depending upon the cause.

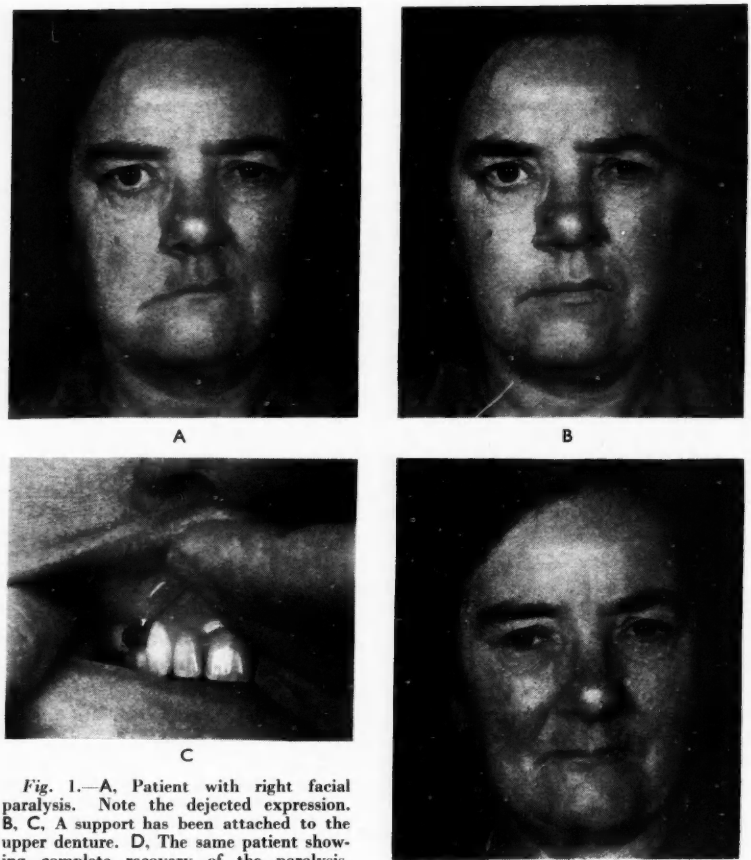

Fig. 1.—A, Patient with right facial paralysis. Note the dejected expression. B, C, A support has been attached to the upper denture. D, The same patient showing complete recovery of the paralysis. (Dentures out.)

The sudden onset of a facial paralysis causes a person acute distress. It may give rise to a mental depression which occasionally verges on melancholia. The drooping of the mouth and of the eyelid results in a dejected appearance, which adds to the misery of the patient. In fact, those afflicted feel as miserable as they look (*Fig.* 1 A).

Support by a dental appliance and treatment by physiotherapy should be undertaken immediately, regardless of whether spontaneous recovery is likely or operative

treatment is intended. It has been found that it is in the early stages of facial paralysis that wasting of the muscles is most rapid, and failure to support denervated muscles may give rise to persisting weakness.

The dental practitioner should be able to supply the necessary support when called upon to do so (*Fig.* 1 C).

SIGNS AND SYMPTOMS OF PERIPHERAL FACIAL PARALYSIS

The signs and symptoms of peripheral facial paralysis are well known (*Fig.* 2), but the busy practitioner might not resent being reminded of them.

They vary according to the part of the nerve involved and the extent of the paralysis. The muscles of the forehead as well as those around the lips, eye, and nose are involved, which affects emotional and voluntary movements.

On requesting the patient to close the eyes tightly, the eye on the affected side remains open due to the paralysed orbicularis oculi. The bulbus oculi can be seen to roll upwards and inwards which is the normal behaviour when the eyes are closed ("Bell's sign").

The patient cannot wrinkle the forehead, frown, or raise the eyebrow on the affected side. The forehead creases are seen to be smoothed out.

The nose cannot be wrinkled on the affected side.

With the mouth at rest, the angle of the mouth on the affected side is seen to be below the level of that on the sound side. When the patient smiles, the mouth is dragged over towards the sound side displaying the teeth only on that side. The patient speaks out of the normal side of the mouth.

Whistling or pouting is impossible.

There is a tendency to drool when drinking and food is retained in the sulci on the affected side.

The nasolabial fold disappears on the affected side and the face has a drawn

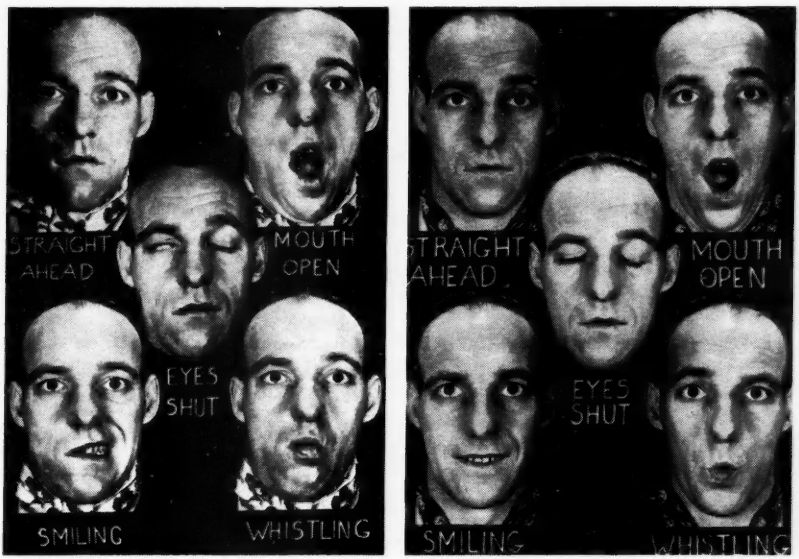

Fig. 2.—A, The characteristic signs of a patient with a right facial paralysis. B, The same patient showing complete recovery.

appearance. When the paralysis is of long standing, the lower lid is dragged down with the sagging cheeks.

AETIOLOGY OF FACIAL PARALYSIS

Facial paralysis may be divided into three main groups:—

Group 1: *Bell's palsy*

Group 2: *Traumatic facial paralysis*

a. Accidents

b. Operations

Group 3: *Infection in the ear or mastoid process*

a. Acute suppurative otitis media

b. Chronic suppurative otitis media; caused chiefly by cholesteatoma

Group 1: Bell's Palsy.—Bell in 1850 is credited with having been the first to describe this lower motor-neurone paralysis. Even to this day, there is a tendency to apply the term "Bell's palsy" to all cases of facial paralysis regardless of aetiology, whereas the term should be applied only to those cases of facial paralysis of spontaneous origin which occur as an isolated condition, and where it is impossible to demonstrate a local causation.

Many of the patients with Bell's palsy referred to the writer for lip and cheek supports have stated that the paralysis occurred during the night, and they were unaware of the deformity until a relative drew their attention to the drooping of the angle of the mouth. Many claim that they were in a draught during a journey, but all authorities do not accept this cold air theory. There is no evidence of a higher incidence in the winter months.

Collier (1953) suggests that an infective origin such as a neurotrophic virus may be responsible for Bell's palsy, because of the tendency for it to occur in groups or small epidemics. There may be a herpetic eruption (herpes zoster) on the skin of the ear, tympanic membrane, palate, fauces, uvula, and tongue. This is the so-called Ramsay Hunt syndrome (1907) which draws attention to the probable geniculate ganglion origin of facial paralysis. In some cases the eighth nerve is involved by the spread of infection from the geniculate ganglion with resulting vertigo, deafness, vomiting, and tinnitus.

It is also suggested that it may be due to a neuritis of the facial nerve from a focal sepsis originating in the mouth, tonsils, or nasal cavity.

Kettel (1947) believes that paralysis may be caused by a lesion of the vasa nervorum in the Fallopian canal. This is classified as Vascular Occlusion Facial Paralysis, but it is not accepted by all authorities.

Group 2: Traumatic Facial Paralysis.—

a. Accidents: The facial nerve may be partially or completely destroyed in fractures of the skull, gunshot wounds of the ear and the region about the ear, and cuts and stabs occurring from broken glass in car accidents.

b. Operations: The facial nerve may be damaged at fenestration and other mastoid operations. (Also under Group 2 may be added parotid tumours and injury caused by obstetric forceps at birth.)

Group 3: Infections in the Ear or Mastoid Process.—In acute suppurative otitis media, œdema arising from middle-ear suppuration creates the pressure on the facial nerve which causes the paralysis. The paralysis resolves with the ear condition. Cholesteatoma in chronic suppurative otitis media may erode the outer wall of the Fallopian canal and involve the facial nerve.

TREATMENT OF FACIAL PARALYSIS

The treatment of facial paralysis is by (1) the provision of a dental support, (2) physiotherapy, and (3) surgery.

1. DENTAL SUPPORTS

Most authorities agree that support of paralysed muscles is an essential part of the treatment of these peripheral nerve injuries so as to maintain the muscles in a position of relaxation. To avoid damage, the muscles should not be stretched by their antagonists nor by the force of gravity.

Types of Buccal and Lip Supports.—The most popular support is the hook of methylmethacrylate resin reinforced with metal which is attached to the patient's upper denture, or to a cast splint cemented to the upper posterior teeth when the natural dentition is present. The hook passes round the angle of

the mouth so as to lift it to the natural position (*Fig.* 3).

The writer is astonished that this intra-oral hook support is the only type known to many in both the medical and dental professions, although it is an advancement over the extra-oral hook support. This consists of a wire bent into a hook at one end to pass round the angle of the mouth, and into a wider hook at the other end to pass round the ear. In spite of the tissues being given protection from the wire hooks by sleeves of rubber, this method causes unavoidable injury to the tissues because of the tension which must be applied to give adequate support.

More important, the method actually causes stretching of the orbicularis oris muscle and those elevators and depressors of the lip inserted into it, not only by the pull of the appliance itself, but by the contraction of the muscles on the sound side (Collier, 1953).

Temporary support can also be given by stretching elastic adhesive tapes from the angle of the mouth, across the cheek to the temporal region. This method offers better support than the other two because, in addition to supporting the angle of the mouth, it also supports the cheek and orbicularis oculi in the lower lid for which, it is claimed, no satisfactory support has been devised apart from closing the eye with cellophane strapping. It can only be used as a temporary support because the skin does not always tolerate these adhesive materials for long periods, especially when it has to be removed daily for electrical treatment. With the other two methods, it has also the disadvantage of being unsightly.

No matter how skilfully the intra-oral hook is constructed it is always obvious, and if worn for a long period, it usually causes drooling of saliva. The skin at the angle of the mouth, and the non-mucous part of the lip, become saturated with the excess flow of saliva. As a result, these tissues may become macerated, which weakens their resistance to the pressure from the hook. Eventually they may fissure, giving rise to a painful traumatic angular cheilosis. It might be considered that such disadvantages are outweighed by the support the appliance affords, but the writer feels that this is not justified because the cheek is just as needful of support as the angle of the mouth. Although the area of effective support afforded by a hook attached to the denture appears to be so limited, the fact cannot be disregarded that there is probably less

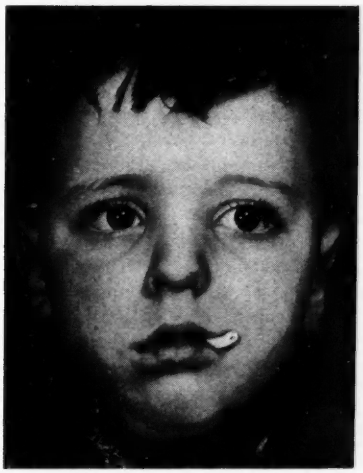

Fig. 3.—Child with a hook attached to the upper teeth to support the lip. (This hook is unnecessarily large.)

danger of stretching the paralysed muscles than with the appliance recommended by the writer.

One can only state that recovery has never failed to be complete in those cases of Bell's palsy which have been supported by the method described in this article. Equal in importance is the effect of the hook appliance on the patient, for it has already been pointed out that those afflicted are often in acute distress, not only from the "dead feeling" of the affected side of the face, but by the dejected appearance the paralysis creates. Bearing this in mind, one can appreciate the effect of a resin hook protruding from the corner of the mouth, drawing more attention to their affliction.

These disadvantages of the hook method prompted the writer to concentrate on a completely intra-oral support, to be described later, and the method which has been adopted

at the Sheffield Dental Hospital is based on the tube retention of Allen and Northfield (1944) and the intra-oral support of Fickling (1951). It must be admitted that any intra-oral support will give a slightly swollen appearance to the cheek and upper lip in those with full facies, but this deformity can be accepted more readily than the hook and adhesive tape methods.

2. PHYSIOTHERAPY

Failure to maintain the contractile power of thin facial muscles results in wasting and fibrosis of these muscles. Physiotherapy consists of supplying electrical stimuli by galvanism, with very gentle massage and, when recovery is imminent, by facial exercises. The massage should not be undertaken by the inexperienced, for there is danger of injuring the toneless muscles which lie superficially to bone. The facial exercises are only permitted when voluntary movement of the muscles is observed. These exercises are taught to the patient who conducts them before a mirror. Movement of the muscles on the sound side is restrained with the hand, in an attempt to make the weakened muscles contract equally with the normal. Exercises conducted in the absence of voluntary movement will give rise to over-action of the muscles on the sound side resulting in excessive stretching of the paralysed muscles. Until voluntary muscle action is noticed, the patient is actually encouraged to avoid facial expression as much as possible so that the muscles on the sound side will not stretch those on the affected side.

Stretching of denervated muscles increases the rate of wasting, which takes the form of replacement of muscle-fibres by fat and connective tissue. It appears that the muscles most affected in this way are the frontalis and the elevators of the upper lip. The frontalis is especially vulnerable, prolonged denervation of which seldom results in recovery (Collier, 1953).

3. SURGERY

Although Bell's palsy is treated usually by dental supports and physiotherapy—occasionally a decompression is indicated. The procedure is to expose the whole length of the inflamed and swollen nerve within the Fallopian canal, and in this way relieve the pressure.

In traumatic facial paralysis the nerve may be decompressed as above, or if the nerve-ends are separated they may be brought together. If there is a gap between the nerve-ends this may be bridged by a nerve-graft. The lateral cutaneous nerve of the thigh is usually selected. Recovery may take six months or longer after nerve-grafting. Support by a dental appliance and physiotherapy are essential parts of the treatment.

In acute otitis media, a simple mastoid operation to drain the infection may be needed. In chronic otitis media, a radical mastoid operation is performed and the cholesteatoma which may be pressing on the exposed nerve is removed. Again facial muscle support and physiotherapy are indicated.

Naturally the prognosis varies with the different types. It is unusual for Bell's palsy not to recover completely. The earlier the treatment after onset, the speedier the recovery.

This article is concerned mainly with the dental aspect in the treatment of facial paralysis, and it is now proposed to describe the intra-oral supports designed by the writer.

Intra-oral Cheek and Lip Support.—*Fig.* 4 illustrates the appliance when the patient is wearing a full upper denture. It will be seen that it consists of a tube, retained in the denture, and a U-shaped strip of oval-bar wire which carries the actual support made in resin.

At one time, tubing, square or oval-shaped in cross-section, with bars of corresponding shape to prevent rotation, was used. This tubing was not only difficult to procure, but the material of which it was made was nickel silver which, having a low corrosive resistance, became foul in the mouth. *Fig.* 1 C shows one of these earlier supports. The tube of nickel silver has been covered with resin to reduce corrosion. This difficulty was overcome satisfactorily by constructing tubes in the dental laboratory, the materials used being stainless steel and dental oval-bar wire.

Construction of the Appliance when the Patient is wearing a Full Upper Denture.—

Construction of the tube: A rectangular strip, half an inch wide by one and a half inches

long, is cut from a sheet of gauge 4 polished stainless steel. This is bent in the middle over a straight strip of stainless steel oval-bar wire, gauge 3. The tube so formed is made to fit the bar by tightening the free ends in a vice. The free ends may be welded or soldered together. It is not essential to fix them together by either method, but by so doing, the tube retains its shape more accurately. The free ends are now roughened to improve the retention of the tube to the denture (*Fig.* 4 A–D).

Fixation of the tube to the flange of the denture: A recess is cut in the buccal flange of the denture on the afflicted side below the necks of the premolar and the molar teeth. This recess is to accommodate the retaining part of the tube which may have to be reduced in width because it must not extend to the periphery of the denture.

The tube should be parallel to the occlusal surface of the teeth.

Cold-cure resin is used to retain the tube in the flange of the denture whether the material be resin or vulcanite. This avoids distortion by strain relief which results when dentures are reprocessed. The appliance is constructed more quickly when cold-cure resin is used, and the tube can be removed more readily when the treatment is completed.

Fig. 4 E shows the tube retained in the denture ready for the adjustment of the bar which will carry the resin support.

Adjustment of the bar: A length of stainless steel bar 3 in. long is bent in the centre to form a "tight" U-shape (*Fig.* 4 F and G). The bar has to be bent in its wide surface and not in its narrow oval section. The distance between the legs of the "U" should be $\frac{1}{4}$ in. approximately. When one leg of the bar is slid into the tube, the other should lie above it but not above the periphery of the denture. The bend of the bar should not extend beyond the canine, and the free end of the lower leg may have to be reduced to accomplish this so that it is flush with the posterior end of the tube.

In order that the resin forming the future support can encircle the upper leg of the bar for firm retention, it will have to clear the flange of the denture together with the cold-cure resin retaining the tube, by at least $\frac{1}{8}$ in. The upper leg and that portion of the lower leg anterior to the tube should be curved to follow the curve of the flange of the denture. Finally, the upper leg of the bar should be roughened to improve the retention of the resin support

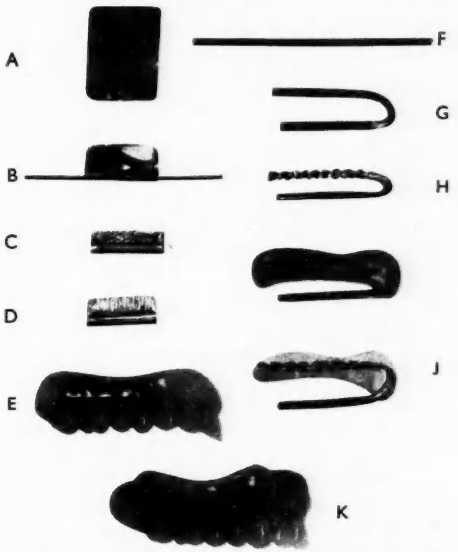

Fig. 4.—A–E, The construction of the tube; F–J, The construction of the support; K, The completed appliance. (For details *see* text.)

which is to encircle it (*Fig.* 4 H). The bar and tube are now in readiness for the support.

The impression of the sulcus for the resin support: The roughened leg of the U-shaped bar is covered with softened modelling wax. The flange of the denture is smeared with petroleum jelly, and the other leg of the bar is pushed into its tube. In this way, the wax is adapted to the flange of the denture and the support is not prevented from being inserted and removed from the tube with ease.

The amount of wax to support the cheek and lip is difficult to estimate. The periphery of the denture should have been hollowed out to accommodate the zygomatic process of the maxilla. This area will not tolerate much increase in height because the pressure of the support would compress the tissues of the sulcus against the bone, giving rise to possible

inflammation or ulceration of the tissues apart from pain resulting from the pressure on the bone. Anteriorly to this region, the support may be increased in height well above the periphery of the denture. In fact, failure to do this renders the appliance useless, for it is only by increasing the height of the periphery of the denture that support is given to the cheek. This increase in height is permissible because there is no muscle action in facial paralysis.

Care must be exercised not to extend the support too far posteriorly to the zygomatic process of the maxilla or contact will be made with the ascending ramus of the mandible and, in some instances, with the coronoid process, which gives rise to severe pain on opening and closing the mouth. The width of the support need not be greater than $\frac{1}{4}$ in. It is the height of the support which, by distending the sulcus upwards, gives support to the sagging tissues. Anteriorly, the wax may be thickened to bring the angle of the mouth to the level of that of the sound side, although care must be taken not to overdo the thickening of the appliance so as to stretch the muscles. The amount of wax required in this region will vary with the degree of restoration of the canine eminence afforded by the denture before paralysis occurred. Care must be taken not to extend the wax too far anteriorly so that it occupies a position relative to the ala of the nose, for, in this event, patients usually complain of pain on wiping the nose.

The writer extends the modelling wax slightly above the periphery of the denture, and with the support in position on the denture, the height of the wax is increased by nearly $\frac{1}{2}$ in. with soft registration wax—reduced in the region of the zygomatic process, and the denture is seated firmly in the mouth.

The cheek on the affected side is then pulled gently outwards and downwards, two or three times. The excess wax displaced buccally by these movements widens the support more than $\frac{1}{4}$ in. and is removed. Over-extension can be reduced if necessary when the patient has worn the appliance for a few days, but under-extension is useless, for it cannot give support. After the wax has been chilled, it is made as smooth as possible (*Fig.* 4 I). The support is removed from the tube, and the wax replaced by heat-cured resin in the manner familiar to the dental laboratory (*Fig.* 4 J). *Fig.* 4 K shows the completed support.

The Advantages of the Removable Support.—The reader will probably be wondering why it is necessary to have the support removable, for by thickening the flange of the existing denture, and increasing its height, the same degree of support would be obtained as for a removable one. Admittedly, this method would be more simple, but the increased height of the flange greatly reduces the retention of the denture and, although theoretically paralysed muscles will not exert downward pressure on the flange, unless the mouth were opened widely, it has been found that many dentures are displaced during mastication when a flange is extended sufficiently to give adequate support, although obviously this displacement is dependent upon the fit of the denture. Should there be movement of the denture during mastication, there is a risk of injury to the tissues of the sulcus by the extended denture flange, and further, when the paralysed muscles are recovering, they will gradually exert a downward pressure on the extended flange which will not only displace a denture which previously may have been stable, but increase the risk of injury to the tissues. There may be a tendency for patients with facial paralysis to favour the affected side and to masticate exclusively on the sound side. Under these conditions, the presence of the support may tend to stretch the paralysed muscles more than if it were removed.

It is for these reasons that the support is so made that it can be removed easily by the patient. The paralysed muscles may not be subjected to so much stretching, and retention is not impaired during mastication and consequently the risk of injuring the tissues of the sulcus is reduced.

Supports for Non-edentulous Conditions.—In addition to the edentulous patient, the dentist may be called upon to provide buccal supports when the following conditions prevail:—

The patient may be wearing a partial upper denture which has a posterior saddle on the affected side.

The natural posterior teeth may be absent on the affected side, but no partial denture is worn.

All the natural teeth may be present on the affected side.

The Construction of an Appliance when the Patient is wearing a Partial Upper Denture which has a Posterior Saddle on the Affected Side.—It is assumed that the partial denture is essential for masticatory efficiency, so that the support is to be removable for the reasons given above.

A buccal flange of an existing partial denture can be utilized to retain the tube which carries the U-shaped bar.

To facilitate the contouring of the support, a model of the sulcus and the buccal wall of the alveolar process on the affected side is desirable. This is best obtained by taking an impression in an alginate material with the partial denture in situ. The denture is retained in the impression on removal from the mouth, or inserted into it should the denture not come away. A model cast from this impression will give the regions required.

The construction of the tube and bar and the contouring of the support are identical to those already described for the patient with a full upper denture.

The Construction of an Appliance when the Natural Molar Teeth are Absent on the Affected Side, but no Partial Denture is worn.—When one or two molars have been "conveniently" lost on the affected side, a resin base plate is constructed with the necessary clasps to retain the appliance. The support need not be removable under these conditions so that there is no necessity for the tube fixation and the removable U-shaped bar. The support is built on to the saddle area of the base and extended into the buccal and labial sulci as described previously.

The whole base with the support is removed for meals without affecting masticatory efficiency, hence the need for a tube and bar support does not arise.

Constructing an Appliance when all the Natural Teeth are Present on the Affected Side.—As mentioned previously, this problem is usually overcome by attaching the support to a sectional cast cap-splint which is cemented to the posterior teeth on the affected side (*Fig.* 5). Unfortunately there are objections to this method. The cap-splint invariably raises the bite with the resultant discomfort to

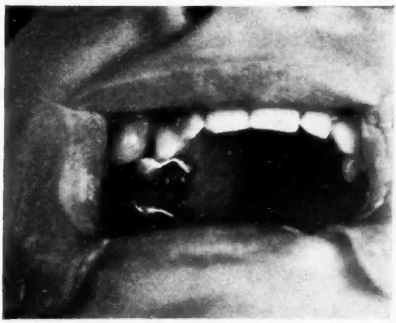

Fig. 5.—A cast cap splint applied to the upper posterior teeth to which is soldered the tube which carries the resin support. All the natural teeth are present.

the patient and risk of dislodgement of the splint during mastication.

In short-crowned deciduous or permanent teeth retention is difficult or impossible, and after the support has been cemented into place, any subsequent easing or addition can be undertaken only by removing the splint.

These objections can be overcome by the use of an orthodontic band. As most practitioners are aware, this consists of a tightly-fitting sleeve constructed from a length of stainless steel tape equal in diameter to the first molar. The ends are brought together so as to provide sufficient overlap for spot-welding or soldering.

It is customary to construct the band at the chair-side. With it in position, a sectional impression is taken in an alginate impression material so as to include all the teeth on the affected side as far as the lateral and the undistorted sulcus. The band may come away in the impression when the latter is removed, but should it fail to do so, it is removed from the mouth and inserted into the impression before casting.

The tube, constructed as before, is now positioned so that it tends to slope downwards anteriorly, to facilitate the insertion of the future support by the patient. Great care

should be exercised in ensuring that it clears the lower teeth in eccentric movements of the mandible. If the buccal cusps of the plaster molar encircled by the band are cut away, it is possible to hold the tube in position with one or two spot welds, but prior to this, it is advisable to reinforce the buccal curve of the

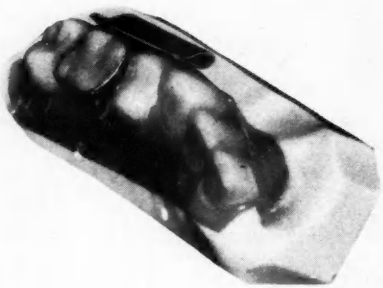

Fig. 6.—An orthodontic band adapted to an upper molar on a demonstration model to which is soldered a tube to carry the support. An alternative method to that shown in *Fig.* 5.

band with a strip of the tape-steel. It has been found that spot-welding alone does not afford a strong enough union, and soldering is essential. Naturally, all sharp edges must be removed with a rubber wheel to avoid lacerating the cheek in contact with the tube.

The oval bar to carry the resin support is bent into a U-shape as described previously. It should clear the buccal aspect of the teeth, the alveolar process, and the sulcus in a manner similar to that described when constructing a support on a full upper denture. The model simplifies this task, and that of adding the wax to the bar ready for final adaptation in the mouth so as to distend the sulcus upwards.

It should be arranged so that the support will slide in and out of the tube readily, and so that the wax is just clear of the model during the insertion and removal. Finally, the band with its attached tube is cemented into place, and the support is increased in height with softened registration wax, as described previously, before being replaced by resin.

Fig. 6 shows the tube attached to the band. The patient experiences some difficulty in inserting and removing the support at first, but after practice in front of a mirror, he soon becomes quite adept. In the case of small children, the parents have to be instructed. A Moone's probe will be found to be a very useful aid in the removal of the support.

This support has two main disadvantages. First, there is a risk of food debris collecting posteriorly to it, for the tube reduces the application of the toothbrush. The patient should be instructed to clean the area around the tube and posteriorly to it with cotton-wool held in tweezers, and weekly inspections should be arranged when the area may be thoroughly cleansed. Secondly, if the patient is to have electrical treatment, *this has to be completed before the support is attached.* The presence of the steel band and tube causes severe pain during such treatment. This means that support is delayed and it may influence the speed of recovery. The dentist should ascertain whether electrical treatment has been prescribed, and request to be notified as soon as it has been completed.

Shields for Use in Paralysis and Anæsthesia of the Lower Lip.—Unilateral paralysis of the lower lip often results in that area close to the angle of the mouth being drawn inwards where it may be lacerated severely by the teeth. Surgery on brain or parotid tumours are examples which may give rise to this condition. Injury to or resection of the mandible involving the inferior dental nerve will produce unilateral anæsthesia of the lower lip, and so will alcohol injections in the treatment of trigeminal neuralgia. Although the lip is not necessarily drawn inwards so as to be bitten, some patients do tend to bite the lip and because of the anæsthesia are unaware of the injury taking place. It will be realized that the motor-supply to the lower lip is from the inframandibular branch of the facial nerve, so that when the inferior dental nerve is involved, anæsthesia is produced but movement is normal. Consequently it is easier to construct a shield which will be inconspicuous when the facial nerve is involved, producing paralysis.

When the natural teeth are present, the orthodontic band technique may be used.

The band is placed on the lower first molar. The lower sulcus does not require distending as

in the upper, consequently the bar consists of a single length with a pad of resin at one end to displace the lower lip outwards.

The end of the bar must fit the tube firmly to avoid its displacement by pressure from the lower lip. Similarly, when the patient is wearing a partial lower denture, a tube may be attached to the flange of the denture. The bar carrying the resin shield which holds the lip outwards is constructed as before.

When the cause is any of the three mentioned above, the deformity may be permanent. Oral hygiene must be emphasized to the patient, and frequent inspection is imperative to ensure that the pressure from the resin pad is not causing injury to the lip. Obviously a disadvantage of this suggestion is food being trapped in the sulcus, but if the bar is adapted accurately to lie in the sulcus, the appliance is similar to a labial oval-bar denture, which is an accepted appliance.

Great difficulty arises in constructing such an appliance when the patient is wearing a full set of dentures, for very few lower dentures would withstand the displacing force exerted by the lower lip via the support.

Before such an appliance is decided upon, an attempt should be made to prevent the lip from being bitten by grinding the offending teeth. More drastically, the offending upper or lower teeth, depending upon which will interfere with æsthetics the least, are removed from the base. Unfortunately, though effective, this method usually produces a poor result æsthetically, and is often not acceptable to the patient. When the upper denture is well retained, the writer attaches to the upper flange in the premolar region a resin strip approximately $\frac{3}{8}$ in. wide, and equal in thickness to a sheet of modelling wax. The strip extends outwards to contact the cheek mucosa and reaches a level slightly below the angle of the mouth. The strip of resin is then extended anteriorly to displace the lower lip away from the teeth. The shield is first built up in wax and adjusted carefully in the mouth to avoid the lower teeth during lateral excursion of the mandible.

Although this method is effective, especially in those cases where the cheek too falls inwards, it does tend to form a food trap. It is also difficult to keep it out of sight when the lower lip movement is normal, as it will be when the motor nerve-supply is functional.

The writer has not seen any suggestions in the literature for dealing with this particular problem, and the method described here is only a tentative suggestion, for he realizes that it is far from being ideal. It may be successful in those conditions when tooth grinding or removal of teeth from the dentures are not applicable.

SUMMARY

1. The signs and symptoms of facial paralysis are given and the aetiology and treatment are outlined.

2. The popular method of attaching a hook to the existing denture and the extra-oral methods of support are criticized.

3. A method of constructing an intra-oral removable appliance which will support both the cheek and lift the angle of the mouth is described when the patient is wearing a full set of dentures, a partial denture, and when all the natural teeth are present.

4. The advantages of the patient being able to remove the support during meals are discussed.

5. A means of displacing the lower lip outwards, to prevent the patient from biting it, is suggested.

Acknowledgements.—I am grateful to Mr. A. Young, Consultant Ear, Nose, and Throat Surgeon to the Sheffield United Hospitals, for his guidance on the aetiology and surgical treatment of facial paralysis; to Mr. J. H. Gardiner and his staff of the Orthodontic Department for their co-operation in the construction of the orthodontic bands, and to Mr. Cousins of the Photographic Department, the Charles Clifford Dental Hospital, Sheffield, for the illustrations.

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THE RESTORATION OF GROSSLY CARIOUS PRIMARY MOLARS

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EARLY rapid dental decay has become commonplace in children whose eating habits and mouth cleanliness have been neglected. One of the difficulties of conserving primary teeth with such gross decay has been in providing an adequate restoration (*Fig.* 1).

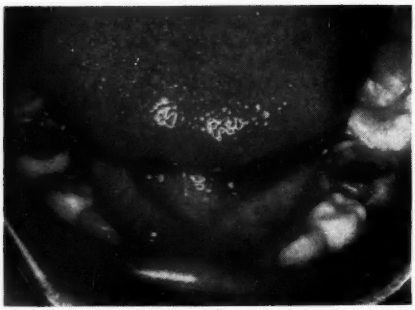

Fig. 1.—Degree of coronal destruction.

The following methods of restoration have been used successfully on primary molars with gross decay.

THE TRU-FORM CROWN RESTORATION

This restoration is a pre-formed metal crown which is manufactured by Rocky Mountain Metal Products Co., and is available in this country. It is contoured and pliered to fit the prepared tooth before it is cemented into position.

Preparation of the Tooth.—The steps are as follows:—

1. The caries is removed and the pulp treated appropriately if this tissue becomes involved, e.g., pulpotomy, or pulp capping.

2. The remaining outer bulbous surfaces of the crown are reduced with diamond disks, so that the walls converge slightly in an occlusal direction. This is an important step in the preparation, since it will be impossible to fit the metal crown-form accurately to the neck of the tooth unless the greatest diameter is at the cervical margin.

3. A sufficient amount of the occlusal surface must be removed to allow for the replacing thickness of the cemented metal crown.

4. Protective linings are now applied to the deep dentine surfaces (*Fig.* 2).

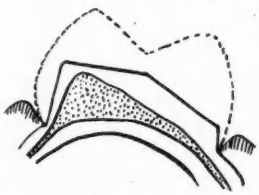

Fig. 2.—Diagram of molar preparation after removal of caries and disking.

Selection of Crown Form.—Four sizes are available for each tooth. The most accurate method of size selection is by measurement at the level of the cervical margin of the prepared tooth. This is effected with a millimetre gauge, and the mesiodistal dimension is compared with that specified on the manufacturer's chart for size selection. An accurate fit at the neck of the tooth is essential to the success of the restoration.

Preparation of the Crown Form.—The neck of the metal crown is trimmed with Bee Bee scissors and contoured to fit the prepared tooth. Crimping or expanding the cervical margin with suitable orthodontic pliers will allow the crown to snap into its final position.

When an accurate fit is obtained, the occlusion is checked and the crown removed for polishing.

Cementing the Crown.—The tooth is isolated with cotton-wool rolls and saliva ejector. Ames Copper Cement is used for cementing the crown, because of its ability to set in the presence of moisture and its antiseptic

properties (Turkheim, 1953). A thin mix of this cement is placed in the crown form, which is then positioned and its occlusion re-checked (*Fig.* 3).

Where a prepared tooth is placed under observation for a probationary period, the metal crown serves as an excellent vehicle for a sedative dressing.

Fig. 3.—The completed restoration.

THE AMALGAM CAP CROWN

This restoration is a stainless steel molar band which is anchored to the tooth by means of amalgam keyed into the occlusal surface over which it is extended to form a cap.

Preparation of the Tooth.—The preparation is similar to that for the Tru-form crown, with the addition of vertical keyways cut in the lingual and buccal surfaces.

The steps in the preparation are as follows:—

1. Removal of caries.
2. The treatment of the pulp, if this tissue becomes involved, and protection of deep dentine surfaces.
3. Reduction of outer bulbous surfaces of the crown.
4. Reduction of the occlusal surface to allow for the thickness of the amalgam cap.
5. Cutting the four vertical keyways (*Fig.* 4).

Preparation of the Band.—It has been found that a 5·0 × 0·15 mm. stainless steel band is sufficiently broad and rigid for the manufacture of this crown.

The method of adaptation and welding of the band is precisely similar to that employed for orthodontic molar bands (McKeag and Freil, 1939). Where no welder is available stainless steel solder may be used in the band construction.

The Positioning of the Crown.—The tooth is isolated and the finished band is placed firmly on the prepared tooth and its occlusal height adjusted. The keyways and the space between the band and preparation are packed with amalgam, which is extended over the whole occlusal surface to a functional height and contoured. The occlusion is again checked (*Fig.* 5).

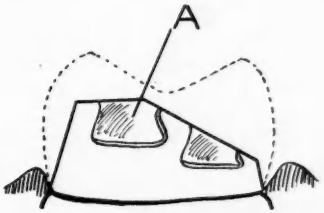

Fig. 4.—Diagram of molar prepared for amalgam cap restoration.

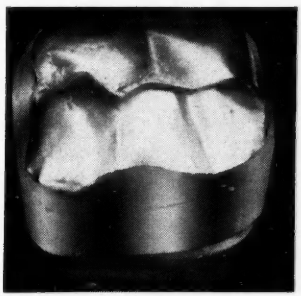

Fig. 5.—The completed amalgam cap crown.

Auto-polymerizing acrylic resin may be used instead of amalgam, since it has the advantage of wearing at the same rate as the enamel of primary teeth, thereby simulating normal occlusal attrition.

MODIFICATION OF THE AMALGAM CAP CROWN

The tooth preparation and making of the band are the same as for the previous crown, but a broad occlusal steel strut is added

during the band construction (Slack, 1954). This increases the rigidity of the crown.

Preparation of the Band.—The band is constructed as for the amalgam cap crown. An additional piece of steel tape is bent into a shallow M which fits within the diameter of the band, and in the buccolingual position. The ends are trimmed and split so that the occlusal surface presents a shallow groove (*Fig.* 6).

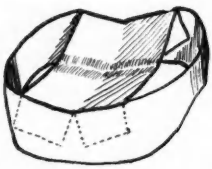

Fig. 6.—Diagram of occlusal strut welded within the band.

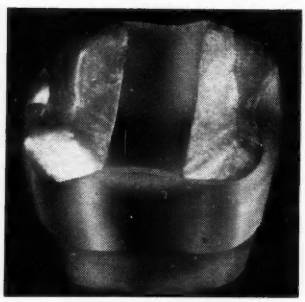

Fig. 7.—The completed modified band restoration.

The strut is welded within the band which is placed on the tooth to check its fit and occlusion.

Cementing the Crown.—After isolating the tooth, a thin mix of Ames Copper Cement is run into the band crown, which is then positioned firmly on the tooth. Excess cement is extruded through the occlusal windows on either side of the strut. Just prior to hardening, the cement is cleared from the windows, which are then plugged with amalgam, making a continuous metal surface over the crown.

Since the windows are small, little contouring of the amalgam is necessary. (*Fig.* 7.)

This form of crown also serves as a strong retainer for sedative dressings in teeth which have been deeply excavated and are under observation. The broad strut protects treated pulp surfaces from occlusal pressure and greatly reduces the solvent action of saliva on the sedative dressing. When the pulp response is satisfactory it is an easy matter to remove and clean the crown before permanently recementing as described above.

Case Report.—Patient is a girl, aged 6 years, with grossly carious primary molars as shown in *Fig.* 1.

All the teeth proved vital on investigation, and were restored with Tru-form crowns and modified amalgam cap restorations (*Fig.* 8).

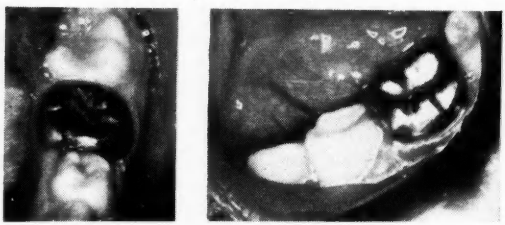

Fig. 8.—The restoration of $\overline{e}$ using a Tru-form crown.

ADVANTAGES OF THESE METHODS OF RESTORATION

1. Extensive loss of crown substance makes classical restorations impossible. Crowning or banding of primary molars offers the only hope of securing sufficient retention to build the tooth to a functional height and mesiodistal dimension.

2. The technique is simple. Extensive disking is usually unnecessary where there is so little crown tissue.

3. The crowns are constructed directly, though several may be produced simultaneously if indirect techniques are employed.

4. Providing the heat of disking is controlled, there is little chance of pulp damage during preparation. The vertical keyways are broad but shallow, and nowhere extend deeply into dentine.

5. The advantages of the Tru-form and band crown for retaining sedative dressings have been discussed.

6. The use of these crowns is not confined to vital molars and they may be employed

where pulps have been mummified or in root-filled molars which are retained for their value to the occlusion. Additional retention may be obtained in these teeth by inserting dentine screws into the root canals.

7. Spaces caused by the loss of adjacent teeth can be maintained by the addition of contoured wire loops to the crown preparation. The construction of the space maintainer in these cases will be by the indirect method.

8. The crowns are efficient and prevent any recurrence of dental caries.

Amongst the restorations described, the writer prefers the Rocky Mountain Tru-form Crown, because of its pleasing appearance and the ease with which it can be fitted.

SUMMARY

Three methods of restoring grossly carious primary molars by means of stainless steel crowns and bands are described, together with their use for retaining sedative dressings and in space maintenance.

Acknowledgements.—I wish to thank Mr. J. S. Bailie, of the Photographic Department of the School of Dental Surgery, for the production of the photographs.

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LETTERS TO THE EDITOR

April 6, 1959

Dear Sir,

Let us try and get this digit-sucking controversy quite clear because I suspect that Mr. Leech and I are much nearer to each other than our correspondence would suggest. All I have claimed in the matter is that there are a considerable number of cases where digit-sucking and digit-sucking alone is the cause of a malocclusion. The number of these cases is not infinitesimal, as Mr. Leech suggests, because I can count them! I agree that many children suck their digits without producing a malocclusion, but again many children have all the conditions requisite to produce an interdental sigmatism but do not lisp. We must never lose sight of the importance of the concept that the human organism has a great variety of responses to various stimuli.

I must most definitely quarrel with Mr. Leech's parenthetical comment that the child will give up the habit (digit-sucking) in his own time, irrespective of corrective appliances. I know many adults who still suck their digits. We see a very considerable number of children in their 'teens who have persisted in the habit and present intractable malocclusions which would have been much easier to treat had the habit been checked earlier.

It is true that some children give up the habit voluntarily, but many continue unless something is done. I used to describe the appliance I use for this purpose as a deterrent, but now I call it a reminder plate, which is an indication of the change in my concept of the whole business. I now consider that digit-sucking in the greater proportion of cases is a persistence of an infantile pattern of behaviour and its continuation after the age of 3 or 4 is an indication that the child has not overcome that particular hurdle of maturation. There is some evidence that in this it resembles enuresis, and there seems to be some relation between digit-sucking and enuresis, but this is a subject which can hardly be considered in the present context. Suffice it to say that we tell the child that the plate is to remind him or her not to suck, and in a large proportion of cases the habit is relinquished immediately. If the child is young enough, and there is no potential towards other types of malocclusion, the open bite closes, the superior protrusion disappears, and the lower incisors come forward, all without any active treatment and in a very short space of time. If the sucking habit is superimposed on an endogenous malocclusion pattern, then we have, subsequently, to treat that malocclusion. In short, digit-sucking can produce a characteristic malocclusion which has nothing to do with endogenous skeletal patterns. It is a distinctive malocclusion in its own right.

The incidence of this condition is fairly high in this part of the world. It may be different in the South of England—I just do not know.

I would say that I have re-read Mr. Leech's sections in which he states that he has gone into the problem of the lip trap in great detail, but I can find nothing which describes the type of lip trap that I mean which is admirably described by Sclare in the *British Dental Journal*, May 21, 1957.

Finally, as an older man with regrets that life is short and art is long, let me suggest to my younger colleagues some lines of thought in relation to digit-sucking which might lead to interesting results: (1) The relation between digit-sucking and enuresis or other infantile patterns of behaviour; (2) The relation between digit-sucking and activity of the other hand—hair twisting, etc. If the sucking ceases does the other habit cease? (3) Posterior palatal sensitivity. Is it less in digit-suckers than in other children? (4) Personality changes when the habit is discarded. Is there a tendency to corresponding maturation in other aspects of the child's life? (5) The psychological background. Are there several reasons why children suck their digits? Do some do it as a persistence of an infantile pattern, do some do it because of some psychological stress?

Yours faithfully,
B. R. Townend

Central Dental Clinic,
9 *Bond Street, Wakefield.*

April 23, 1959

Dear Sir,

Mr. Townend has kindly sent me a copy of his letter of April 6 to your JOURNAL and I should be grateful if you would grant me space in your columns to reply.

It seems to me that we have only two main differences of opinion. These are the incidence of the digit-sucking habit and its resulting malocclusion, and the extent to which the harm produced necessitates corrective treatment.

Mr. Townend states: "The incidence of this condition is fairly high in this part of the world. It may be different in the South of England—I just do not know." My answer to this is that I have given in my paper clear-cut figures for the incidence in the Chelsea district where my survey was carried out. If Mr. Townend will produce figures for his part of the country this part of the problem will be solved.

I might add that my survey was carried out in a group of children attending an E.N.T. department. The incidence of malocclusion would, therefore, not be as high as in the selected dental group of Mr. Townend's clinics, and would be nearer the true average for the population as a whole.

The answer to the second part is more difficult and I can only state my own personal opinion. I believe that my paper shows that the habit affects the alinement of the teeth only and has no affect on the growth of the jaws themselves. For this reason I would not advocate corrective treatment unless the habit persisted until after the eruption of the permanent incisors; even then a chat with the patient is very often all that is necessary. Even so, I think the parents are more concerned with the anti-social nature of the habit and their own unwarranted sense of shame and neglect rather than with the relatively minor derangement of the teeth. This is why I ask that the habit (if indeed it is a habit) be put into its right perspective. Only recently a friend of mine was told by her medical practitioner that the habit in her 4-month-old child must be stopped at all costs, by tying down the hands if necessary, to prevent serious and lasting harm. In my opinion this is deplorable advice which I would never sanction.

Yours sincerely,

H. L. LEECH

The Watford and District Peace Memorial Hospital,
Watford,
Herts.

April 4, 1959

Dear Sir,

May I through the courtesy of your JOURNAL reply to Mr. T. H. M. Wynne's letter regarding my article on removable appliances. He correctly states their successful use in my hands, and I may assume by other orthodontists as well. I would suggest that Mr. Wynne devotes five years to a careful comparative study and use of these appliances, as I have done, following which his hypothetical criticisms may find a basis for discussion.

Yours faithfully,

JOSEPH ANGELMAN

12 *Rodney Street,*
Liverpool, 1.

BOOK REVIEWS

MOTIVATING PATIENTS FOR MORE EFFECTIVE DENTAL SERVICE. By J. LEWIS BLASS, Ph.G., D.D.S., F.A.C.D., F.A.D.M., Associate Professor of Periodontia and Oral Medicine, Lecturer in Practice Management, New York University College of Dentistry. 9×6 in. Pp. 176+xii, with 16 illustrations. 1958. Philadelphia: J. B. Lippincott Co. (London: Pitman Medical Publishing Co.) 50s.

THIS book is a report on a Study Group in Practice Management, which was set up "to learn how to manage patients so that they will want a dentist's services. It included the recognition and the relief of the patient's psychological tensions, his education, and motivation to co-operative acceptance of services. An objective psychological appraisal was made of each participating dentist to aid him toward an understanding of his own behavior and emotions. The application of this insight enables the dentist to secure better relationships with patients as well as greater professional satisfaction, practice growth, achievement, compensation, and the personal emotional maturity which leads to heightened effectiveness."

So writes Dr. Blass in the preface of *Motivating Patients for More Effective Dental Service.* This book may have considerable interest to the dentist practising in the United States, but it seems out of step with present day practice in Great Britain. D. D. D.

ORAL DIAGNOSIS. By DONALD A. KERR, D.D.S., M.S., Major M. ASH, jun., D.D.S., M.S., and H. DEAN MILLARD, D.D.S., M.S. $9\frac{3}{4}\times6\frac{3}{4}$ in. Pp. 419, with 212 illustrations. 1959. London: Henry Kimpton. 75s.

IN this book the authors describe three types of examination: a thorough examination, a screening type of examination, and the emergency type. They recognize that with experience a diagnosis may be reached by a history

and examination which is brief, yet elicits all the information relative to the problem in hand. They appear to fail, however, in showing how the student may progress to this state from his initial stage in which he collects as many details as he can, relevant or otherwise. The detailed examination, indispensable as it may be in certain cases, is not practicable for all patients in a busy practice.

The value of the thorough examination is seen in the case presented in the last chapter, but the case used in the chapter on radiology does not illustrate the value of the more selective approach as in the reviewer's opinion it could. Here the changes produced by a neoplasm are described amid a whole wealth of detail about the state of the patient's teeth and periodontal tissues. While these other details may be important in the final management of the case, the manner in which they are presented almost obscures the important cause of the patient's pain.

These criticisms apart, there is much in this book which will profit the reader, whatever his diagnostic experience. G. R. S.

GENERAL PATHOLOGY AND BACTERIOLOGY FOR DENTAL STUDENTS. By RONALD L. BISHTON, M.D., Consultant Pathologist to the Bath Clinical Area, Late Lecturer in Pathology, University of Bristol. $8\frac{3}{4} \times 5\frac{1}{2}$ in. Pp. 320+viii, with 112 illustrations. 1958. Bristol: Wright. 42s.

THE design of this book is unusual, in that a number of chapters on Bacteriology are intermingled with those on General Pathology, with a view to linking the two subjects as much as possible. In this it is not wholly successful, partly because the integration is not as close as it would have been if a combined chapter on the organism and the disease had been written, and partly because the balance of treatment is uneven. About two-thirds of the book is occupied with detailed descriptive bacteriology; these sections are full and accurate and very well done, but there is surely a good deal more about the culture and biochemistry of many organisms than the dental student really requires—the *Neisseria* and some of the *Clostridia* for example; there are four pages on the genus *Hæmophilus* but only one on the healing of a fracture. There is disproportion too in the Pathological chapters; by all means let a dentist take examples from the head and neck, and cover the salivary tumours well, but adenolymphoma is overrated with a paragraph and two photomicrographs when carcinoma of the lung—much in the public eye—is hardly mentioned. The general approach is well supported by a good chapter on the aetiology of cancer. A general book for the specialist is indeed one of the most difficult to write, but perhaps the degenerative diseases—much to the fore at the present time—merit more extended treatment in future editions, and space could be made for this without enlarging the book by damping down the rarities and the technical bacteriology. The photographs and the production of the book are a credit to all concerned. J. W. L.

A TEXT-BOOK OF ORTHODONTICS. By ROBERT H. W. STRANG, M.D., D.D.S., Director of Courses in Orthodontics in the Extension Teaching Department of Temple University; Director of the Fones School of Dental Hygiene, University of Bridgeport, Connecticut; and WILL M. THOMPSON, B.S., D.D.S., Instructor in Advanced Orthodontia, Postgraduate Division, Temple University School of Dentistry, Philadelphia. $9\frac{1}{8} \times 6$ in. Fourth Edition. Pp. 880, with 1178 illustrations as 647 figures and 5 plates, some in colour. 1958. London: Henry Kimpton. 150s.

THIS is the fourth edition of a well-recognized and accepted orthodontic text-book. In this edition a chapter on cephalometrics has been added, written by Will M. Thompson, who is the new co-author.

The first half of the book deals with the development of occlusion, normal growth and development, and the aetiology of malocclusion. The authors have drawn extensively from recognized authorities on these subjects and they give due acknowledgement to other writers.

Treatment and technique make up the second half of the book. The former is based

largely on the principles advocated by C. H. Tweed. In dealing with technique, the authors have confined themselves to the edgewise arch method, which is described in great detail both as regards working in the mouth and at the bench. There seems to be no book more suitable for a postgraduate student who wishes to study the edgewise arch technique.

It would have been helpful if some of the illustrations could have been larger. Where treated cases are shown, comparison would have been easier if all the models of each case had been put on facing pages. However, these are small criticisms of a presentation that is of a generally high standard.

J. S. R.

ABSTRACTS FROM OTHER JOURNALS

Radiation Hazards in Dentistry

Because of the short distances involved in dental radiography the radiation is very high; it is ten times as high as that for a chest film. Excessive radiation to the eye can cause blindness; to the jaw, interference with bone development and tooth eruption or actual necrosis; to the breast, lung shrinkage; to the hands, keratoses and malignancies. The doses are cumulative.

The genetic hazard of radiation is a subject about which there is little knowledge but much suspicion. The one large-scale human experiment, the bombing of Hiroshima, has so far produced no apparent genetic effects.

The dentist, working daily with X-rays, can avoid danger to himself by keeping his hands out of the direct beam; he can avoid scattered radiation by standing well away from the machine and it is suggested that the switch should be fixed to a far-off corner of the surgery. To protect the patient, radiation should be reduced to the minimum. This can be achieved by using a long cone, a lead diaphragm, and an aluminium filter up to 3 mm. in thickness. The cone of a dental X-ray machine should be long enough to allow a minimum distance of 8 in. between the tube anode and the patient's skin. The lead diaphragm reduces the area of the beam and will actually improve the quality of the X-ray picture—its window need not exceed $\frac{3}{4}$ in.

A final precaution is reassurance of the patient in view of the frightening reports in the lay press regarding the dangers of radiation. No one need suffer if a full-mouth X-ray examination is made every year for thirty years. The dose of medical radiation to the population is probably less than one quarter as much as the unavoidable dose from natural sources of radiation from the sun, the earth, and from the radio-active salts within one's own body.—DE VILLIERS, P. D. (1959), *J. dent. Ass. S. Afr.*, **14**, 42.

An Evaluation of Hydroxyzine Hydrochloride as a Pre-operative and Post-operative Adjunct in Dental Procedures

Tranquillizers have replaced barbiturates in dental practice for dealing with apprehensive patients. Hydroxyzine hydrochloride (Atarax) was used in this series of cases. It is thought to act through the hypothalamus which controls emotions. It is particularly free of side-effects, and the therapy was discarded in only 2 cases and then because of drowsiness.

With a total of 305 patients from normal practice, 1128 procedures were performed successfully. The usual dosage was one 10 mg. tablet three times a day and 10 mg. one hour before the appointment—in the case of afternoon appointments the dosage would be a total of six tablets. In oral surgery cases, followed by immediate dentures, dosage was continued at 30 mg. per day for 2 weeks post-operatively, in an attempt to build up the patient's confidence in the dentures.

The results of the test showed patient behaviour after medication to be fair to excellent in 76 per cent of cases and good to excellent in 69 per cent.—CAPPER, B. (1958), *Aust. dent. J.*, **3**, 371.

CRANIAL AND FACIAL MEASUREMENTS AND CORRELATIONS IN ARAN ISLAND CHILDREN

By R. B. DOCKRELL, M.A., M.B., B.Ch., M.Dent.Sc.

THE present investigation falls into two parts which are quite distinct except that the same material has been used in both. In the first part, it was wished to find out the variation in the different measurements and also the variation between different families. In order to do this, it was necessary to standardize the population for age and sex, and these essential corrections have given a sample within which one can draw firmer conclusions than would be possible were conditions less stabilized, but mean that comparisons between this investigation and others become more difficult. There have been many investigations into the degree of resemblance or variation to be found in families and usually these have taken the form of comparing the occlusion, certain measurements, angles, or tooth size of parents with those of children (Begg, 1932; Russell Marsh, 1933; Rubbrecht, 1939; Moore and Hughes, 1942; Snodgrasse, 1948; De Coster, 1952; Tulley, 1952; Curtner, 1953; Ikeda, 1953; Haralabakis, 1954; Stein, Kelley, and Wood, 1955; Asbell, 1957) or of comparing monovular or binovular twins (Bachrach and Young, 1927; Detlefson, 1928; Korkhaus, 1928 and 1930; Reif, 1928; Goldberg, 1929; Hohl, 1934; Martin, 1934; Lundström, 1948; Bonello, 1958).

In the second part of this investigation, the degree of correlation between the various measurements is considered without any reference to the inter-relationships of many of the children. In respect of this part, many investigations have been carried out which compare in some way with the present investigation (Smyth and Young, 1932; Fleming, 1933; Shepherd, Sholl, and Vizoso, 1949; Howells, 1951, 1952; Lindegård, 1953; Björk, 1955; Scott, 1955; Sarnås, 1956). Whilst many of these authors have been concerned mainly with the factors responsible for the correlations, rather than the size of the correlation coefficients, there has been a certain amount of overlapping with the present investigation where similar or comparable measurements were concerned.

MATERIAL

The material for the present investigation was collected as a result of two visits, three years apart, to the largest of the Aran Islands. The Aran islanders are a mixed population of farmers and fishermen, and the largest island has a population of approximately 1000. The historical researches of J. R. W. Goulden suggest that they are largely of English stock with more mixture of Irish stock from the mainland lately, and this is borne out by the research of Hackett and Folan (1958) into the blood groups of the islanders. They found frequencies which approximate more to the south of England than to the neighbouring parts of the mainland. The following measurements were made with a cranial callipers on the living subject:—

1. Auricle (midpoint on posterior surface of right tragus) to nasion (skin over junction of nasal bone and cartilage).
2. Auricle to superior alveolar point (anterior margin of the gum papilla between the upper central incisors).
3. Auricle to menton (most anterior point of chin in midline).
4. Head length (maximum length from glabella anteriorly to back of head).
5. Head width (maximum width over parietal bones).
6. Face width (maximum width over zygomatic bones).
7. Nasion to menton (lowest point of chin in midline).
8. Nasion to superior alveolar point.

In the present investigation, the measurements of 157 children, 86 males and 71 females, ranging in age from 6 to 14 years were used. The children came from 51 families and there

Given at the meeting held on December 8, 1958.

Table I.

Dimension	Error of Measurement (30 Individuals)	Error of Error (30 Individuals)	Mean	Error of Mean	Standard Deviation	Error of Standard Deviation	Coefficient of Relative Variation	Error of Coefficient of Relative Variation	Standard Deviation of Intrafamily Variation	Variance Ratio
Auricle to nasion	1·19	±0·15	109·95	±0·35	±4·37	±0·25	3·97	±0·22	3·64	2·41
Auricle to superior alveolar point	1·53	±0·20	107·35	±0·34	±4·24	±0·24	3·95	±0·22	3·44	2·68
Auricle to menton	2·14	±0·28	118·34	±0·42	±5·25	±0·30	4·44	±0·25	4·49	2·15
Head length	1·93	±0·25	180·04	±0·57	±7·20	±0·41	3·99	±0·23	5·91	2·54
Head width (Biparietal)	1·44	±0·19	145·82	±0·40	±5·07	±0·29	3·48	±0·20	3·90	3·16
Face width (Bizygomatic)	1·38	±0·18	122·49	±0·37	±4·68	±0·26	3·82	±0·22	3·97	2·24
Nasion to menton	1·35	±0·17	98·26	±0·44	±5·48	±0·31	5·58	±0·31	4·49	2·54
Nasion to superior alveolar point	1·96	±0·23	59·93	±0·30	±3·77	±0·21	6·29	±0·35	3·37	1·81
Formula	$\sigma_1 = \sqrt{\left(\frac{\Sigma d^2}{2N}\right)}$ Where d equals the difference between 2 measurements on the same individual	$\sigma_{\sigma_1} = \frac{\sigma_1}{\sqrt{(2N)}}$	$\overline{X} = \frac{\Sigma X}{N}$	$\sigma_{\overline{x}} = \frac{\overline{X}}{\sqrt{(N)}}$	$\sigma = \sqrt{\left\{\frac{\Sigma(X_1 - \overline{X})^2}{N}\right\}}$	$\sigma_\sigma = \frac{\sigma}{\sqrt{2N}}$	$V = \frac{100\sigma}{\overline{X}}$	$\sigma_v = \frac{V}{\sqrt{2N}}$	$\sigma_w = \sqrt{\{\Sigma K(\overline{X} - \overline{X}_F)^2\}}$ Where K equals the number in any particular family and $\overline{X}_F$ equals the mean for that family	$\frac{\sigma_B{}^2/N_1}{\sigma_w{}^2/N_2}$ Where σ_w is the variance within the families and N_1 and N_2 the number of families and the number of children

was one family of 6 children, 2 families of 5 children, seventeen families of 4 children, 11 families of 3 children, and 20 families of 2 children. Because a previous investigation on the islanders (Dockrell, Clinch, and Scott, 1954) had shown significant age and sex differences, and because regression equations were available, the children were all brought to ten years of age (observed measurement $\pm$ difference in months from 10 years of age multiplied by the increment for that sex and for that measurement) and corrected for sex (observed measurement multiplied by $\frac{\bar{x}m+\bar{x}f}{2(\bar{x}m \text{ or } \bar{x}f)}$). These corrections of the observed measurements introduced a source of error and in order to minimize this only children whose ages lay between 6 and 14 years were used in the investigation so that the corrections for age were limited to a maximum of 4 years in any one individual. The figures of 10 years $\pm$ 4 years are quite arbitrary; the figure of 10 years representing an approximate mean age for the whole island sample and the figure of 4 years a compromise between letting the correction for age involve too great a part of the whole value for any child and the reduction of the numbers which a narrowing of the age limits involved. The restriction meant reducing the number of children in many families, but was felt to be essential. The assumption that any particular child is growing at the standard linear male or female rate is not warranted, but the error is probably small, and Smyth and Young (1932) found a good fit when straight lines were fitted to their 8–14-year-old material. The validity of applying regression equations which had been plotted on the whole population to a sample was tested and no significant difference was found between the means for the corrected sample and the whole. Double determinations to determine the error of measurement had been carried out on a series of 30 children. All measurements are given in millimetres.

FINDINGS

The results of the double determinations are shown (*Table I*, columns 1 and 2). These show errors ranging from 2·14 mm. for the auricle to menton measurement to 1·19 mm. for the auricle to nasion measurement. As the measurements were all made with the same cranial callipers by the same investigators, differences in the size of the error may be presumed to be due to the difficulty in locating some of the points on living children. The significance of the differences between the errors was tested (*Table II*). These show a significantly larger error for auricle to menton than for any other and a significantly smaller error for auricle to nasion than any other. As the point auricle is common to both, the difference between the errors must be due to the greater difficulty in locating the point menton anteriorly than the point nasion, and in this case is probably due to the difficulty in getting the children to keep their teeth in occlusion while the measurement is being made. In the same way, the error for nasion to superior alveolar point is significantly larger than that for nasion to menton and this must be due to the difficulty in locating the superior alveolar point vertically because it is also significantly larger than the error for auricle to superior alveolar point, which is fairly low. Head length has an error which is significantly larger than most of the others although it is significantly less than auricle to menton.

The mean, its error, the standard deviation, its error, the coefficient of relative variation and its error were then calculated (*Table I*, columns 3–8). It must be emphasized at this point that these figures for such a highly standardized sample of population have very little value in an absolute sense and their value lies more in the possibility of comparison between the figures for the various measurements than in a comparison with the figures for other populations. It is, however, of interest to note how closely they approximate to other workers' figures for London children (Smyth and Young, 1932; Fleming, 1933). Where the measuring points are similar, the means and standard deviations are very close, and even where the points are different, the coefficients of relative variation are close. The only exception to this lies in the measurements

nasion to superior alveolar point and face width where a genuine sample difference is likely. *Table I*, column 5, shows that, of the three radial measurements, both auricle to nasion and auricle to superior alveolar point have very similar standard deviations, that for auricle to superior alveolar point being smaller. Smyth and Young's findings are similar for these three measurements although they measured from the transmeatal axis posteriorly, but in their case the standard deviation of transmeatal axis to nasion is less than that of transmeatal axis to upper incisor incisal edge. The significance of the differences between the standard deviations was also tested (*Table III*). This shows head length to have a significantly greater deviation than any other measurement, and nasion to superior alveolar point to have a significantly smaller one than any other apart from auricle to nasion and auricle to superior alveolar point. *Table I*, column 7, shows the coefficients of relative variation. These show that although head length has the largest deviation, its deviation relative to its size is not as high as that of auricle to menton, nasion to menton, nor nasion to superior alveolar point which, although it has the smallest standard deviation, is the most variable relative to its size. This latter was also Smyth and Young's finding. Once again there is a tendency for the three radial measurements auricle to nasion, auricle to superior alveolar point, and auricle to menton to group themselves together with similar figures and as before auricle to nasion and auricle to superior alveolar point do not differ significantly from one another while auricle to menton has a significantly higher standard deviation. In the same way there is a tendency for head width and face width to have similar deviations and coefficients of variation. The intrafamily and the interfamily variances were then calculated and the variance ratios obtained (*Table I*, column 10). Lundström (1948) working on monovular and binovular twins considered certain dental measurements and estimations, and found quotients for $\frac{\text{genetic factors}}{\text{non-genetic factors}}$ varying from 2·8 for arch width in the first premolar region to 0·8 for sagittal occlusion at the 1st permanent molar. In a later paper (1954) he measured certain angles on lateral cephalograms and found values for the same quotient varying from 1 to 2. Dockrell (1956) calculated the intrafamily and interfamily variance ratios for the size of certain teeth and found values ranging from 6·8 to 1·2. The values in the present investigation lie within the ranges of those for the permanent incisors and molars and the deciduous incisors and canines, and all are significant at the 5 per cent level. A high quotient for any particular measurement shows that the measurement is tending to be more alike in brothers and sisters than its overall variance justifies, and in this case head width is showing the greatest similarity followed by auricle to superior alveolar point and head length. The overall variance is made up of the intrafamily variance and the interfamily variance divided in accordance with the ratio given, and from these figures the standard deviation for the intrafamily variation can be obtained (*Table I*, column 9). The significance between the differences in the intrafamily standard deviations was then tested (*Table IV*). The significance of the differences between the overall standard deviations in *Table III* and between the intrafamily standard deviations in *Table IV* can be compared with one another and both deviations can be compared with the related variance ratio (*Table I*, columns 5, 9, and 10). When the tables are compared it can be seen that the order is similar in *Tables III* and *IV* except that head width, which had a larger overall deviation than face width, has a smaller intrafamily deviation than it. Although the difference between the two measurements is not significant in either table, this has had the effect of increasing the variance ratio for head width so that it is the highest investigated. Fewer of the differences between the deviations achieve significance in *Table IV* than in *Table III* as one would expect with the smaller numbers.

In the second part of the investigation, the correlation coefficients between the various dimensions were calculated and the results are given (*Table V*). There was no reason why

the figures for such inter-related children should have been used in this section, and it is possible that these relationships may have altered the correlation coefficients to a significant degree although the general similarity of the findings to those of other workers do not suggest heavily loaded figures. There was a good reason for using figures which had been standardized for age and sex because the different rates and times of growth for the

Table II.—Significant Differences between the Errors of Measurement at the 5 per cent Level

Dimension	Auricle to Menton (2·14)	Nasion to Superior Alveolar Point (1·96)	Head Length (1·93)	Auricle to Superior Alveolar Point (1·53)	Head Width (1·44)	Face Width (1·38)	Nasion to Menton (1·35)
Auricle to Nasion (1·19)	S	S	S	S	S	S	S
Nasion to Menton (1·35)	S	S	S	S	NS	NS	
Face Width (1·38)	S	S	S	S	NS		
Head Width (1·44)	S	S	S	NS			
Auricle to Superior Alveolar Point (1·53)	S	S	S				
Head Length (1·93)	S	NS					
Nasion to Superior Alveolar Point (1·96)	S						

Dimensions are arranged in descending order of the size of the error horizontally across the top and in ascending order vertically on the left. Therefore column 1 vertically gives the dimensions which have a smaller error than auricle to menton and column 6 vertically the dimensions which have a smaller error than face width. In the same way, column 3 horizontally gives the dimensions which have a larger error than face width. The letters "S" or "NS" indicate whether the difference between the errors is significant or not at the 5 per cent level.

Table III.—Significant Differences between the Standard Deviations of the Mean at the 5 per cent Level

Dimension	Head Length (7·20)	Nasion to Menton (5·48)	Auricle to Menton (5·25)	Head Width (5·07)	Face Width (4·68)	Auricle to Nasion (4·37)	Auricle to Superior Alveolar Point (4·24)
Nasion to Superior Alveolar Point (3·77)	S	S	S	S	S	NS	NS
Auricle to Superior Alveolar Point (4·24)	S	S	S	S	NS	NS	
Auricle to Nasion (4·37)	S	S	S	NS	NS		
Face Width (4·68)	S	S	NS	NS			
Head Width (5·07)	S	NS	NS				
Auricle to Menton (5·25)	S	NS					
Nasion to Menton (5·48)	S						

See footnote, *Table II.*

different dimensions must alter the correlations and it is apparent that correlation coefficients should be considered as related to a certain age and sex group rather than as absolutes. These figures should be considered as relating to a highly standardized 10-year-old population and the possibility of loading due to blood-ties kept in mind. The values are all positive and their significance was tested at the 5 per cent level, light type indicating a

Table IV.—Significant Differences between the Intrafamily Standard Deviations at the 5 per cent Level

Dimension	Head Length (5·91)	Nasion to Menton (4·49)	Auricle to Menton (4·49)	Face Width (3·97)	Head Width (3·90)	Auricle to Nasion (3·64)	Auricle to Superior Alveolar Point (3·44)
Nasion to Superior Alveolar Point (3·37)	S	S	S	NS	NS	NS	NS
Auricle to Superior Alveolar Point (3·44)	S	S	S	NS	NS	NS	
Auricle to Nasion (3·64)	S	S	S	NS	NS		
Head Width (3·90)	S	NS	NS	NS			
Face Width (3·97)	S	NS	NS				
Auricle to Menton (4·49)	S	NS					
Nasion to Menton (4·49)	S						

See footnote, *Table II.*

Table V.—Correlation Coefficients and their Significance at the 5 per cent Level

Dimension	Nasion to Superior Alveolar Point	Nasion to Menton	Face Width	Head Width	Head Length	Auricle to Menton	Auricle to Superior Alveolar Point
Auricle to Nasion	0·372	0·504	0·458	0·215	0·477	0·534	0·690
Auricle to Superior Alveolar Point	0·363	0·703	0·462	0·190	0·384	0·721	
Auricle to Menton	0·258	0·443	0·511	**0·110**	0·284		
Head Length	0·330	0·417	0·194	**0·090**			
Head Width	**0·018**	**0·135**	0·383				
Face Width	0·237	0·354					
Nasion to Menton	0·667						

All values are positive. Light type figures are significant. Heavy type figures are not significant.

Correlation coefficient $r = \frac{\Sigma(x_1-\bar{x})(y_1-\bar{y})}{N\sigma_x \quad \sigma_y}$

Significance tested at 5 per cent level by t test $\left(t = \frac{r}{\sqrt{(1-r^2)}}\sqrt{(N-2)}\right)$

If $t > 1{\cdot}96$ the correlation is considered significant.

significant correlation and heavy type the lack of a significant correlation. All the dimensions show significant correlations with one another apart from head width, which shows low correlations: head width/nasion to superior alveolar point, head width/nasion to menton, head width/auricle to menton, and head width/head length, failing to achieve significant correlations, as does head length/face width. Again there is a grouping of the figures as one would expect. The three radial measurements, auricle to nasion, auricle to superior alveolar point, and auricle to menton, show high correlations with one another, slightly lower correlations with nasion to menton, still lower with face width and head length, and least with head width. Head length has generally low correlations which are not significant with head width and face width. Nasion to menton has higher correlations with the other dimensions than has nasion to superior alveolar point and the two show a

Table VI.—Significance of Differences between the Correlation Coefficients for the Dimension Auricle to Nasion at the 5 per cent Level

Auricle to Nasion and	Auricle to Superior Alveolar Point (0·690)	Auricle to Menton (0·534)	Nasion to Menton (0·504)	Head Length (0·477)	Face Width (0·458)	Nasion to Superior Alveolar Point (0·372)
Head Width (0·215)	S	S	S	NS	NS	NS
Nasion to Superior Alveolar Point (0·372)	S	NS	NS	NS	NS	
Face Width (0·458)	S	NS	NS	NS		
Head Length (0·477)	S	NS	NS			
Nasion to Menton (0·504)	NS	NS				
Auricle to Menton (0·534)	NS					

See footnote, *Table II.*

Table VII.—Significance of Differences between the Correlation Coefficients for the Dimension Auricle to Superior Alveolar Point at the 5 per cent Level

Auricle to Superior Alveolar Point and	Auricle to Menton (0·721)	Nasion to Menton (0·703)	Auricle to Nasion (0·690)	Face Width (0·462)	Head Length (0·384)	Nasion to Superior Alveolar Point (0·363)
Head Width (0·190)	S	S	S	NS	NS	NS
Nasion to Superior Alveolar Point (0·363)	S	S	S	NS	NS	
Head Length (0·384)	S	S	S	NS		
Face Width (0·462)	S	S	S			
Auricle to Nasion (0·690)	NS	NS				
Nasion to Menton (0·703)	NS					

See footnote, *Table II.*

high correlation with one another. Where the measuring points are similar, there is fairly close agreement with the figures of Smyth and Young and Fleming, and especially with their menton are close to theirs. The pattern is the same in that auricle to superior alveolar point/auricle to menton has a higher correlation than auricle to nasion/auricle to superior alveolar

Table VIII.—Significance of Differences between the Correlation Coefficients for the Dimension Auricle to Menton at the 5 per cent Level

Auricle to Menton and	Auricle to Superior Alveolar Point (0·721)	Auricle to Nasion (0·534)	Face Width (0·511)	Nasion to Menton (0·443)	Head Length (0·284)	Nasion to Superior Alveolar Point (0·258)
Head Width (0·110)	S	S	S	S	NS	NS
Nasion to Superior Alveolar Point (0·258)	S	S	NS	NS	NS	
Head Length (0·284)	S	NS	NS	NS		
Nasion to Menton (0·443)	S	NS	NS			
Face Width (0·511)	S	NS				
Auricle to Nasion (0·534)	S					

See footnote, *Table II.*

Table IX.—Significance of Differences between the Correlation Coefficients for the Dimension Head Length at the 5 per cent Level

Head Length and	Auricle to Nasion (0·477)	Nasion to Menton (0·417)	Auricle to Superior Alveolar Point (0·384)	Nasion to Superior Alveolar Point (0·330)	Auricle to Menton (0·284)	Face Width (0·194)
Head Width (0·090)	S	S	S	NS	NS	NS
Face Width (0·194)	S	S	S	NS	NS	
Auricle to Menton (0·284)	NS	NS	NS	NS		
Nasion to Superior Alveolar Point (0·330)	NS	NS	NS			
Auricle to Superior Alveolar Point (0·384)	NS	NS				
Nasion to Menton (0·417)	NS					

See footnote, *Table II.*

first order partial correlations when age is constant. In the present investigation the values for auricle to nasion/auricle to superior alveolar point and for auricle to nasion/auricle to menton fall between the male and female values of Smyth and Young, and those for auricle to superior alveolar point/auricle to point and this is higher than auricle to nasion/auricle to menton. In the same way the low correlation of head width/head length, which fails to achieve significance, is in agreement with Fleming's first order partials when age is constant. Comparisons with other investigators using material of differing ages

is more difficult, but both Howells (1951, 1952) and Lindegård (1953) agree in finding higher coefficients studied than between head width and the others. Howells, analysing a number of factors to determine their influence on the coefficients, found significantly positive correlations between most of the comparable dimensions apart from head width. The pattern of his findings is similar to the present investigation although the individual coefficients vary. Lindegård, who was less interested in the correlations between the various cranial, facial, and dental measurements than in the correlations between these measurements and length or sturdiness factors, in measurements on living subjects, found head length/head width, head length/face width, and head length/auricle to menton to have significant positive correlations and auricle to menton/face width to lack significance. The greatest disagreement in the findings concerns two coefficients: head length/head width which

Table X.—Significance of Differences between the Correlation Coefficients for the Dimension Head Width at the 5 per cent Level

Head Width and	Face Width (0·383)	Auricle to Nasion (0·215)	Auricle to Superior Alveolar Point (0·190)	Nasion to M nton (0·135)	Auricle to Menton (0·110)	Head Length (0·090)
Nasion to Superior Alveolar Point (0·018)	S	NS	NS	NS	NS	NS
Head Length (0·090)	S	NS	NS	NS	NS	
Auricle to Menton (0·110)	NS	NS	NS	NS		
Nasion to Menton (0·135)	NS	NS	NS			
Auricle to Superior Alveolar Point (0·190)	NS	NS				
Auricle to Nasion (0·215)	NS					

See footnote, *Table II.*

Table XI.—Significance of Differences between the Correlation Coefficients for the Dimension Face Width at the 5 per cent Level

Face Width and	Auricle to Menton (0·511)	Auricle to Superior Alveolar Point (0·462)	Auricle to Nasion (0·458)	Head Width (0·383)	Nasion to Menton (0·354)	Nasion to Superior Alveolar Point (0·237)
Head Length (0·194)	S	NS	NS	NS	NS	NS
Nasion to Superior Alveolar Point (0·237)	S	NS	NS	NS	NS	
Nasion to Menton (0·354)	NS	NS	NS	NS		
Head Width (0·383)	NS	NS	NS			
Auricle to Nasion (0·458)	NS	NS				
Auricle to Superior Alveolar Point (0·462)	NS					

See footnote, *Table II.*

Howells and Lindegård found to have a significant correlation whereas Fleming and the present investigation did not, and face width/auricle to menton which Howells and the present investigation found to have a significant correlation whereas Lindegård did not. great, the significant coefficients being only just so and the non-significant ones only just failing to reach the level of significance.

The significance of the differences between the various correlation coefficients were also tested (*Tables VI–XIII*). It is interesting to

Table XII.—Significance of Differences between the Correlation Coefficients for the Dimension Nasion to Menton at the 5 per cent Level

Nasion to Menton and	Auricle to Superior Alveolar Point (0·703)	Nasion to Superior Alveolar Point (0·667)	Auricle to Nasion (0·504)	Auricle to Menton (0·443)	Head Length (0·417)	Face Width (0·354)
Head Width (0·135)	S	S	S	NS	NS	NS
Face Width (0·354)	S	S	NS	NS	NS	
Head Length (0·417)	S	S	NS	NS		
Auricle to Menton (0·443)	S	S	NS			
Auricle to Nasion (0·504)	S	NS				
Nasion to Superior Alveolar Point (0·667)	NS					

See footnote, *Table II.*

Table XIII.—Significance of Differences between the Correlation Coefficients for the Dimension Nasion to Superior Alveolar Point at the 5 per cent Level

Nasion to Superior Alveolar Point and	Nasion to Menton (0·667)	Auricle to Nasion (0·372)	Auricle to Superior Alveolar Point (0·363)	Head Length (0·330)	Auricle to Menton (0·258)	Face Width (0·237)
Head Width (0·018)	S	S	S	S	NS	NS
Face Width (0·237)	S	NS	NS	NS	NS	
Auricle to Menton (0·258)	S	NS	NS	NS		
Head Length (0·330)	S	NS	NS			
Auricle to Superior Alveolar Point (0·363)	S	NS				
Auricle to Nasion (0·372)	S					

See footnote, *Table II.*

An examination of the actual figures, however, does much to explain the contradictory findings because one finds that where a correlation coefficient achieves significance in one investigation and fails to do so in another, the real difference between the figures is not usually note that the dimension auricle to superior alveolar point has higher correlation coefficients than any other and that its coefficients show more significant differences between one another than do those of any other dimension. It is easier to demonstrate significant

differences in a dimension which has a very wide range of values for the coefficients or in one which shows many high values and many low ones, i.e., a grouping of the coefficients at both ends of the scale. In the case of auricle to superior alveolar point there does not seem to be a wider scale and the explanation seems to lie in the grouping into three high coefficients separated by a wide gap from the four others. Despite, therefore, its large number of significant differences, the dimension auricle to superior alveolar point can in this material lay claim to be the central dimension of those studied.

There is one finding above all others in this investigation which appears suggestive and which is being singled out for special discussion. The dimension auricle to superior alveolar point has a smaller overall deviation and intrafamily deviation than auricle to nasion. Although these differences are not significant, they are surprising in view of the fact that the superior alveolar point is usually believed to be an unreliable point anteroposteriorly since it is so modified by "local" or "non-genetic factors", whereas the nasion is believed to be free from them. In addition, the superior alveolar point is believed to be affected by the muscles of the lips and tongue whereas the nasion is free from muscular influences. In view of these factors which are affecting only one of the points, one would expect a larger variation in the superior alveolar point rather than a smaller one. If there were a larger variation in the dimension auricle to superior alveolar point than in auricle to nasion, one could look whether it lay in the interfamily variance, suggesting a genetic or familial cause and raising the numerator and therefore the ratio, or partly familial and partly chance keeping the ratio the same, or completely in the intrafamily variance suggesting chance factors raising the denominator and decreasing the ratio.

It is possible that some of these "local" factors, e.g., habits, etc., have a genetic cause and that muscular behaviour is genetically determined as has been stated by Ballard (1954) and this would account for the higher variance ratio of auricle to superior alveolar point, but the rise is small, is not significant, and one must assume that the contribution of these causes is equally small and insignificant and that the lack of a rise in the overall variation is against a marked effect from these causes. In this investigation the superior alveolar point appears to be as stable a point anteroposteriorly as nasion, despite the many factors which may be influencing it, and the correlation coefficients are contributory evidence of the relative stability of this dimension and of the anteroposterior position of the superior alveolar point itself. If this point were being affected to a marked degree by chance factors which are not affecting the other points, then its correlation coefficients should be lower than those of the other dimensions. The fact that they are higher means that it would seem advisable to await more evidence before attributing marked effects on the anteroposterior position of this point to local, dental, or muscular influences.

SUMMARY

1. Eight cranial and facial measurements in each of a group of 157 children lying in 51 families have been reduced to a common age and sex.

2. The mean, the overall standard deviation, the intrafamily standard deviation, the coefficient of relative variation, the interfamily and intrafamily variance ratio, and the correlation coefficients were calculated for each dimension.

3. All the variance ratios were significant at the 5 per cent level.

4. Apart from the dimension head width, all the correlation coefficients between all the dimensions were significant at the 5 per cent level.

5. In view of the lack of a significantly higher standard deviation, coefficient of relative variation, and standard deviation of intrafamily variation of the dimension auricle to superior alveolar point, when compared with auricle to nasion, and in view of its high correlation coefficients, it is questioned whether, in this sample, local, dental, or muscular forces can have had any marked

effect on the anteroposterior position of the superior alveolar point.

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DISCUSSION

Mr. Mills, opening the discussion, congratulated Dr. Dockrell on a most painstaking and thorough piece of research. It would form a standard reference in our transactions for other workers on a borderline of orthodontics and physical anthropology.

The paper, as written, would probably be difficult for the average orthodontist to understand, without a knowledge of statistics. In delivering it, Dr. Dockrell had made the way plain and explained the statistical technicalities in a masterly fashion.

Dr. Dockrell has suggested that the findings would indicate that the soft tissues had little effect on the position of the incisor teeth. Mr. Mills could not altogether agree with this. Several others have shown that where a skeletal abnormality existed this usually lay in the position of the mandible. Downs's "point B" was usually placed posteriorly or anteriorly to "point A". These points, however, would not be affected by the lips and tongue. The effect of the muscles would be to tilt the teeth. This would not materially affect the position of the interdental septum between $\underline{1|1}$ which was the point from which Dr. Dockrell had measured.

Björk had shown that while overjet in extreme Class II, division 1 cases was the usual result of the skeletal pattern, nevertheless, it could be increased by adverse tipping of the teeth or decreased by a favourable tilting. It was difficult to explain this tipping on any grounds other than that of the surrounding soft tissues.

He was very interested in Dr. Dockrell's finding of the importance of genetic factors in determining the skeletal pattern. This confirmed the findings in several other recent investigations. He wondered whether in fact the situation was more marked than would at first sight appear, since many individuals in Aran who were apparently unrelated would probably have some blood-ties owing to

the smallness of the community. Would Dr. Dockrell agree that this was the case?

Dr. Dockrell, in reply, thanked the members for the reception they had given to the paper. It was a privilege to be permitted to address the Society at any time, and an even greater one to do so in the Jubilee Year. In particular, he would like to thank Mr. Mills for his kind remarks and to deal with some of his questions. Mr. Mills had taken him up about the stability of the superior alveolar point. First of all, he must make it quite clear that he had no information about either the angulation of the incisors or the position of the mandible. Both of them were outside the scope of the paper. With regard to the position of the incisor teeth, he had no evidence except in so far as the superior alveolar point offered an indication of the position of the uppers, and all he could say then with any degree of certainty was that if the local factors were tilting the incisors markedly, then the centre of rotation must be close to the superior alveolar point and that Smyth and Young had measured to the incisal edge of the upper incisors with similar results to his. Mr. Mills had referred to his findings about the "importance of genetic factors" and he would like to repudiate any such suggestion. It was very likely that genetic factors did play an important part, but an experiment such as his could demonstrate only familial factors and to ascribe these factors to specific causes was to go beyond his evidence. In fact, he had used the term "genetic" rarely in the paper, and then with reluctance, because he believed it to have a precision which was not equalled by most present methods of investigation. It was, perhaps, possible to apply it to a difference between the findings for monovular and binovular twins, provided one was quite satisfied about the method for assessing the number of ova, but beyond that he felt the term should be used with great caution. With regard to the question about the blood-ties, it was quite true that many of the children were cousins of one another, but he was not sure about the actual effect of this on the findings. In theory, it ought, by limiting the range, to decrease the effect as Mr. Mills had said but, in fact, it need not have done so to a marked degree, and it would be better to wait for the results of an investigation into that problem they had carried out that summer on Aran. Once again he would like to thank Mr. Mills very much for all the trouble he had taken to make his points clear, for his complimentary remarks, and the audience for their attention.

Mr. A. G. Taylor said the meeting had been privileged occasionally to have papers on what might be called physical anthropology. He thought this had been the first paper which had dealt with the British Isles. Nearly all the previous papers had begun with a description of the subjects and their method of life. When one knew in advance the subject of a proposed paper, an opportunity was given to read up literature beforehand. He had, therefore, asked some of his Irish friends what they knew about the Aran Islands. Instead of, as he had expected, being told that the Islands were of a mixed population he had learnt that in recent years they had been a very isolated population. It was thought, however, that there was quite a lot of Spanish blood there, but whether the Spaniards were Celts or whether the Aran Islanders were Celts he really was not quite sure. Irish was, however, spoken there, and he understood that those wishing to obtain posts in the Irish universities were in the habit of going to the Aran Islands to improve their Irish.

He understood that islands had another peculiarity. They had an effect on the people who lived there or visited them. It was a very strange effect, and he thought that Mr. O'Flaherty, who had gone there to make one of the most outstanding films ever produced, might have perhaps felt its influence. A similar effect had appeared to be shown by the works of authors and playwrights, and he wondered if there was an influence cast upon those who visited the Aran Islands.

Dr. Dockrell had said that the people in London were very similar to those in the Aran Islands as regards the deviations, when one came to measurements, in members of the same family. Why did he go to the Aran Islands to get his measurements?

As a preliminary to their papers, authors generally explained how they obtained their measurements. Dr. Dockrell had not explained this; he had said there were perhaps deviations and errors in making the measurements, and, therefore, a fortnight later a check was made in order to ensure the accuracy of the figures. Were the same people taking the measurements, and were they using the same instruments? This was of importance in making statistical analyses.

As regards the statistics in the paper, these were generally difficult until set down in print. He felt sure that it would then prove even more valuable, but it was difficult to discuss the figures which had been presented verbally. One question he would like to raise was why the standard deviation should have error.

Dr. Dockrell thanked Mr. Taylor for his remarks, and said he had had the feeling before the meeting that in whichever form he read the paper he would regret that he had not read the other form. (Laughter.)

He had omitted reference to the method of taking measurements because that had been given in some detail in the *European Orthodontic Society Transactions*, 1954, including notes on the children's diet, etc. The measurements had been made with callipers on the moving children, as it were, and the measurements made a week later were made on the same children by the same operators, with the same instruments. The errors were calculated later.

As to why he had gone to Inishmore in the first place, Miss Clinch or Dr. Scott could tell as much as he could because they had both been there, too. It had seemed reasonable to assume that a small island would be very inbred, and that interesting findings might turn up, due to the appearance of genetic drift. In actual fact, by the time they had gone to the island, they had learnt enough to make it clear that the population was not extremely inbred or, if it were, that that had happened only recently. On other grounds, the island was ideal in that the population was of the right size for their resources, is not subject to migration at school-age, and despite its isolation, is quite accessible.

The question of Spanish blood, of course, was a difficult one. Galway had been a big port in the Middle Ages and as the three Aran Islands blocked the approaches to Galway they had been a nest of pirates. The result was that there were always garrisons on the Islands—Elizabethan garrisons, Williamite garrisons, Jacobite garrisons—largely keeping the people quiet. He did not know how much Spanish blood was in the population, but at least the Spaniards did not seem to have left their names. On the other hand, the English had, and this sense of honour, if he might so call it, had its effect on the islanders' names. The names of the islanders in 1821 revealed an enormous number of what

might be called English, or at least non-Irish surnames, each with very few representatives—that is, one family or perhaps two of a particular name. A change appeared to have taken place since then, in that many of these surnames had died out and had been replaced by numerically fewer Irish surnames most of which were common to a much larger number of families.

With regard to the question about standard deviation and its error, just to make things difficult, of course, the standard deviation was often called the standard error of the mean. He had put in the error of the standard deviation as an index of where the true standard deviation might be for a larger population, just as he had put in an indication of where the true mean for a larger population or the true error of measurement might lie.

The standard deviation for these children might be of little interest in itself and more use might be made of its applicability to a larger population. Assuming a normal distribution, the error of the standard deviation could be used to give the probability of the standard deviation for the larger population's lying within a certain distance of that of these children.

ABSTRACTS FROM OTHER JOURNALS

Domiciliary Thiopentone Anæsthesia

To the question "What drugs and equipment should be carried when intravenous thiopentone is given for a dental operation in the patient's home?" the following answer was given: The following should be carried:—

1. Equipment for the administration of the thiopentone. Ampoules of thiopentone powder and distilled water, sterile syringes, and needles.

2. Equipment for ventilating the lungs should respiratory depression or arrest occur as a result of overdose. While oxygen is excellent, air is quite adequate for this purpose. Ventilation is efficiently carried out by means of a face mask and either the Oxford bellows or the Ruben "ambu" bag. A few sizes of rubber airway should be carried.

3. Drugs for counteracting certain side-effects. Analeptics like nikethamide or vanillic acid diethylamide may occasionally be useful to stimulate a patient who is a little slow to recover consciousness. A separate box should contain ampoules of papaverine, procaine, tolazoline, saline, and hyalase in case of intra-arterial or extravenous injection.

In addition swabs, mouth gags, and dental props, required for any mouth operation, should also be carried.

Whether and when it is advisable to embark on dental surgery and general anæsthesia in a patient's home is quite another and debatable question. Very good reasons indeed are necessary to justify this practice.—*Brit. med. J.* (1959), **1**, 248.

Psychosomatic Dentistry

An analysis was made on how mental complexes might bring about some oral diseases. The impulse to act instinctively causes organs to be stimulated, but should reasoned thinking offer what seems a wise alternative, action might be deliberately curbed. The special chemicals secreted would then not be used and their continued presence might adversely affect parts of the body. An analogy is made with plant galls and examples given.

The damaging presence of a possible secretion may be seen in patients with an inflamed and painful incisive papilla; the papilla situated palatally to the upper central teeth. Although no cause can be found for this condition, similar histories are forthcoming from different patients which relate to conflicts with, e.g., parents; there are emotional tensions and the affliction appears.

The explanation for this is bound up with the organ of Jacobson and the amniotic fluid which circulates freely around it in the human embryo. Although later this organ becomes rudimentary the ducts remain open above and terminate blindly below in the incisive papilla. When a person is in emotional conflict with another person, secretions, which have passed out of use, are provoked and cause congestion of the papilla with resultant soreness.

Trench mouth is prevalent during times of war and the question is raised that secretions provoked by war years so change the oral tissues as to make them specially vulnerable to attack by otherwise harmless spirochætes.—Gorvy, S. (1958), *J. dent. Ass. S. Afr.*, **13**, 327.